RAILROAD GAZETTE

FRIDAY, SEPTEMBER 28, 1900.

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Four-Cylinder Compound Locomotives in France.

At a recent meeting of the Institute of Mechanical Engineers there was presented by M. Edouard Sauvage, member of the Institute, and Assistant Engineer in Chief, having charge of rolling stock and machinery of the Western Railroad of France, a paper on "Recent Locomotive Practice in France." By far the greater portion of the paper* is devoted to descriptions of different types of four-cylinder compound locomotives, a class of engines which has been practically adopted as standard for all new equipment by several of the larger French lines. This portion of the paper is substantially as follows:

Recent locomotives on the French railroads are chiefly remarkable for their high power and because of the fact that very many of them are four-cylinder compounds, there being to-day in France more than 800 locomotives of this type either in service or in course of construction. The four cylinders drive either two, three or four axles. With two driving axles the machines have large wheels and are intended especially for working fast express trains, but they may be also employed advantageously for the heaviest passenger trains, and even in certain cases for goods trains. The locomotives with three axles have also large wheels. They draw easily long goods trains or heavy passenger trains; they have been employed to work express trains, but exceptionally rather than regularly. This type of engine is a very useful one since it is suitable for almost all classes of service; it allows considerable increase in speed for goods trains, which becomes more and more necessary on the principal French lines. For heavy and slow trains, principally on steep inclines, four driving axles are used; but this type of machine is generally less in favor than the preceding and has already become a little antiquated. Much importance is attached to the preservation of the coupling of these axles together, instead of driving separately one axle or a group of axles by each pair of cylinders.†

The advance in the power of engines has brought about an increased weight upon each pair of wheels. A load of about 17 tons per axle is generally allowed in France today, although a few years since 15 tons were seldom exceeded.

Amongst the details of construction one should notice first of all the extent of grate area and the dimensions of the boilers. To obtain a sufficiently large diameter, especially with large wheels, the center of the boiler has been raised from a height of about 7 ft. to a height of 8 ft. 2 in. This necessitates the short stacks characteristic of modern locomotives. It is scarcely necessary to add that engineers have never regretted this increased elevation of boilers; and if there still exists a divergence of opinion in this matter, it is between those who think that there is no disturbance in the stability and those who think that there is a distinct advantage in this respect. The effective pressure of steam in boilers has been carried to 199, 213 and even 228 lbs. per sq. in., the compound system making good use of these high pressures.

Referring to the frames of locomotives, the leading truck has come into general use in France. All compound locomotives with four cylinders and two or three driving axles are thus furnished, with the exception of four constructed before 1889; many of the simple locomotives have also a truck. Another instance of the favor with which trucks are regarded in France is seen in the addition of trucks to old machines. It is also worthy of remark that elegance in the design of locomotives now receives more attention than formerly.

The following information concerning the seven great railroad lines‡ of France (Northern, Western, State, Paris-Orleans, Southern, Paris-Lyons, Mediterranean and Eastern), has been gathered with the kind co-operation of the chief mechanical engineers of those roads. MM. du Bousquet, Clerault, Desdouits, Solacroup, Moffre, Baudry and Salomon. Table I gives a list of the compound locomotives with four cylinders in service or on order on Jan. 1, 1900,** for French Roads, not including the Mallet locomotives for light railroads of one meter gage. Amongst these locomotives of normal gage, four (Nos. 2801-2804 State, constructed in America), are of the Vauclain system with superposed cylinders. Twenty others (Nos. 4,101 to 4,120, Northern, constructed in 1889) have tandem cylinders, with three piston rods in each group, and one valve for a group of two cylinders. These locomotives do not belong to the category of ordinary compound machines with intermediate receiver, but to that of the Woolf type, with steam traversing direct from one cylinder to the other. Putting on one side these two categories of locomotives, all others have four separate cylinders, each with its own separate valve and valve gear. The oldest of these locomotives is No. 701, Northern, Fig. 1, designed, like several of the following, by M. de Glehn, director of the Société Alsacienne de Constructions Mecaniques. The two driving axles of this locomotive, No. 701, are not coupled. The high-pressure cylinders are inside and low-pressure cylinders are outside the frames. In the following locomotives the positions of the cylinders have been changed, which gives the double advantage of placing the exhaust passage from the low-pressure cylinders beneath the smoke-box and fixing the smaller cylinders outside.

Locomotives with two driving axles developed from the first type have been constructed of larger and larger power; then followed the type with three driving axles, often with wheels large enough to permit their taking all except the most rapid trains. In order to still further increase the dimensions of the boilers of high speed engines with two driving axles, the type called "Atlantic" with one carrying axle placed behind the two driving axles, Fig. 10, has been introduced. Two locomotives of this type are being built for the Northern Railway. One may consider the "Atlantic" type as derived from three three-axles-coupled machine, where the trailing axle ceases to be a driver. There is considerable uniformity among the two and three-driving-axles locomotives employed on the different French roads; however, the Paris-Lyons-Mediterranean has designed types of two, three, and also four-coupled axles which are peculiar to that line. As already said, the coupling has been preserved for two driving axles, to omit which would appear possible without inconvenience. It has been found in France that the disturbing forces due to the reciprocating movement of the pistons and obliquity of the connecting rods can be diminished by thus coupling the wheels; the machine runs more smoothly and wears the permanent way less. In addition to this, the coupled wheels are less prone to slip; the steam immediately acts with greater effort, upon the other, making it slip in its turn.

Table II gives various dimensions of four-cylinder compound locomotives. In the most recent locomotives it will be seen that the grate area is about 27 sq. ft.; for certain among them the heating surface approaches 2,153 sq. ft. These areas are calculated from the side of the plates and tubes in contact with the flame and hot gases. The surfaces indicated are not always comparable, for they are not always calculated in exactly the same manner. With the Serve-ribbed tubes, very frequently used, the depth allowed in the calculations for the ribs is not always the same; besides, more or less is allowed for the omission of the ribs for expanding purposes at the two extremities of each tube. The greater number of locomotives have a brick arch in the fire-box. On certain engines of the Paris-Orleans and Southern the Tenbrinck heater is used. The weights have been given in Table II. as they appear on the reports furnished to the author, but it is clear that these weights cannot be exact within 100 lbs.; and they must vary with the condition of the engine. The weights cannot be given accurately for certain very recent or not yet completed locomotives. Figs. 1 to 18 represent the different types of four-cylinder compound locomotives. Those of the Paris-Orleans and State railroads not given, with the exception of the American locomotives of the State railroad, resemble the later types of the Southern line.

The Walschaert valve gear is employed generally in locomotives with four cylinders. This mechanism, having only one eccentric, is suitable for outside cylinders, and it is also applied for inside cylinders. Nevertheless, the Gooch link has been employed for inside cylinders; on the latest compound engines on the Paris-Lyons-Mediterranean. The Walschaert system gives good distribution of steam at the various points of cut-off. The two lifting shafts, one for the two high-pressure cylinders, the other for the low-pressure cylinders, are actuated by two reversing screws placed opposite each other, or one a prolongation of the other; the two can be reversed at will, either together or separately. The drivers are thus able to adjust suitably the distribution for all requirements, and have found from practice in a very short time the best working positions. Admission of steam to the large

TABLE I.—FOUR-CYLINDER COMPOUND LOCOMOTIVES, IN USE OR ON ORDER ON JANUARY 1, 1900.
(Ordinary French Gage.)

Figures	Railroad	Numbers of the Series	Number	Total	Year Ordered	REMARKS
		Locomotives with Two Driving Axles.				
Fig. 1	Northern	701	1	63	1885	Driving axles not coupled radial axle in front.
2		2121-2123, 2137	17		1890 and 1892	
3		2138-2157	20		1894	
10		2158-2160, 2161 2180	23		1895 and 1897	
		2641 2642	2		1898	Type "Atlantic."
4	Western	501 502	2	42	1893	
5		503 542	40		1897 and 1899	
	State	2701 2706	6	10	1895	
		2801-2804	4		1899	American locomotives, Vauclain system.
	Paris Orléans	1-20	20	20	1898	
	Southern	1701 1714	14	48	1893	
6		1751-1774	24		1895 and 1896	
7		1775-1784	10		1897	
	Paris, Lyons, and Mediterranean	C 1 2	2		1887	Two driving axles between two carrying axles.
		C 3	1	135	1892	
		C 11-12	2		1891	
		C 21-60	40		1893	
8		C 61-150	90		1898	
9	Eastern	2401-2432	32	32	1898	
	Total number of locomotives with two driving axles			350		
	Locomotives with Three Driving Axles.					
11	Northern	3121-3170	50	50	1897	
12	Western	2501-2525	25	25	1898	
	Paris-Orléans	1701-1725	25	25	1899	
		1301-1302	2		1895	
13	Southern	1303-1312	10		1897 and 1898	
		1401	1		1895	
14		1402-1415	14	27	1898	
	Paris, Lyons, and Mediterranean	3261-3300	40		1897	Locomotives with four driving axles converted.
15		401-3550	50	90	1898	
16	Eastern	3401 3450	60	60	1898	
	Total number of locomotives with three driving axles			277		
	Locomotives with Four Driving Axles.					
	Northern	4101-4120	20	..	1889	Woolf's system, tandem cylinders.
	Paris, Lyons, and Mediterranean	3201-3202	2	..	1887	
		4301-4302	2	..	1887	
17		3211-3260, 3301-3362	112	..	1892 and 1893	
18		4501-4540	40	176	1891 to 1895	Converted engines.
	Total number of four-cylinder locomotives .. .. .. (This does not include Mallet locomotives for the meter-gage light railroads)			803		

*Published in full in *Engineering*, London, June 29 and July 6, 1900.

†This remark does not apply to M. Mallet's articulated locomotives, used in France on the light railroads of one-meter gage.

‡These seven lines work the greater part of the network of French railroads; there remains a system composed of light railroads, generally with one-meter gage.

**Since that date new orders have been given for locomotives of this kind. The Western Railroad has decided on the construction of a lot of 40.

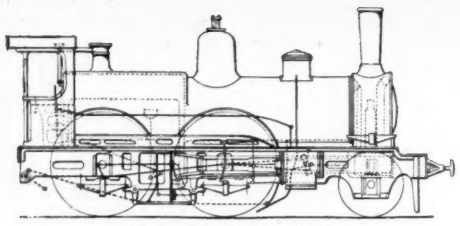

Fig. 1.—No. 701, Northern.

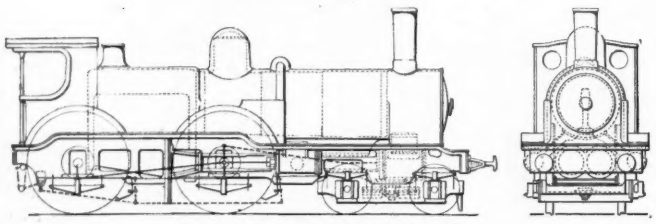

Fig. 2.—Nos. 2138-2157, Northern.

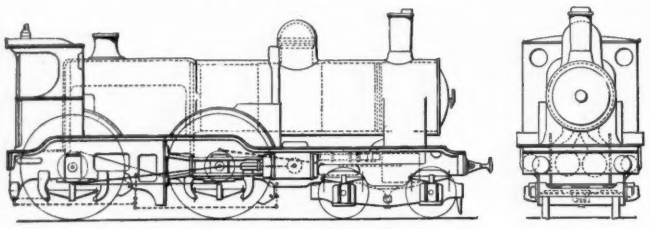

Fig. 3.—Nos. 2161-2180, Northern.

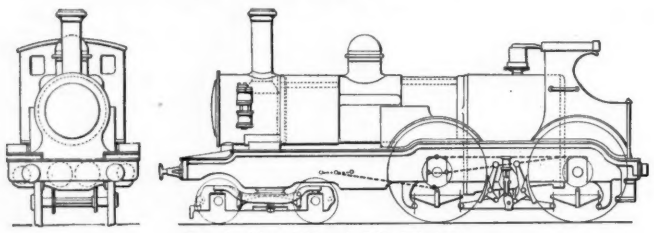

Fig. 4.—Nos. 501 and 502, Western.

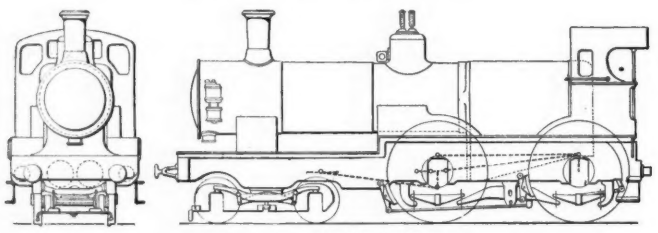

Fig. 5.—Nos. 503-542, Western.

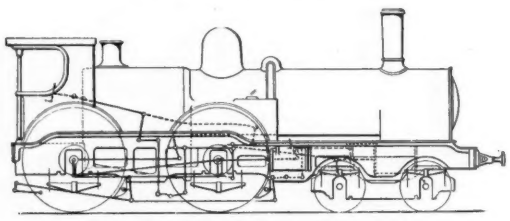

Fig. 6.—Nos. 1701-1714, Southern.

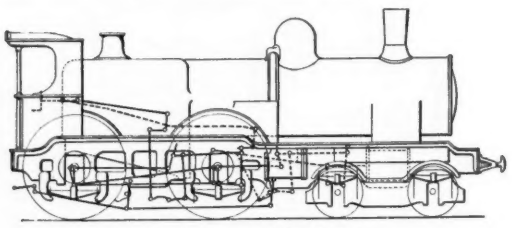

Fig. 7.—Nos. 1751-1774, Southern.

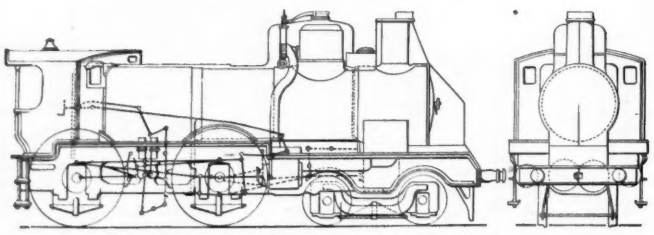

Fig. 8.—Nos. C-61-150, Paris-Lyons & Mediterranean.

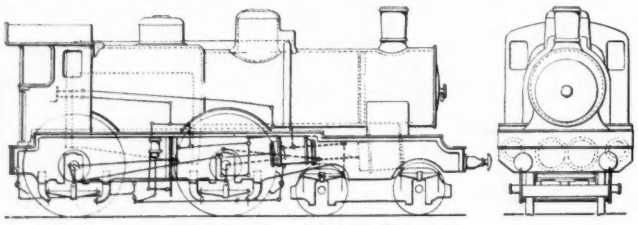

Fig. 9.—Nos. 2401-2432, Eastern.

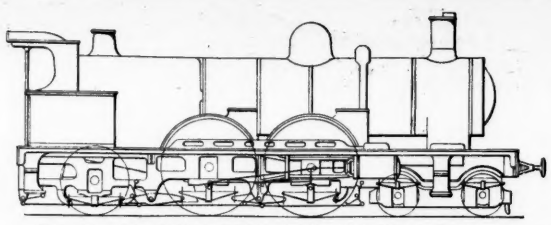

Fig. 10.—Nos. 2641 and 2642, "Atlantic" Type, Northern.

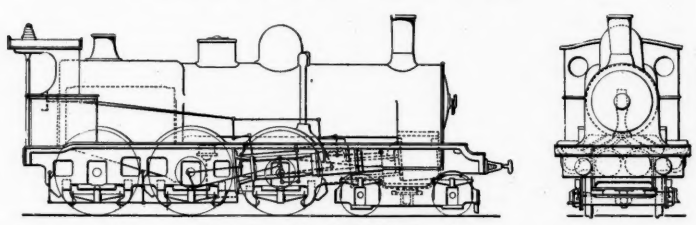

Fig. 11.—Nos. 3121-3170, Northern.

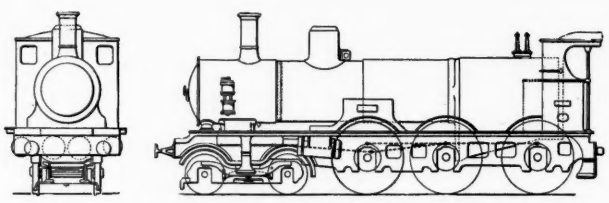

Fig. 12.—Nos. 2501-2525, Western.

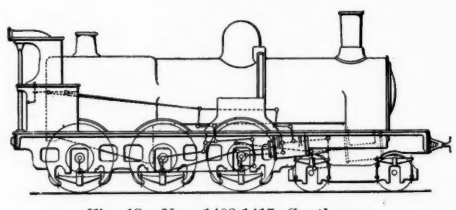

Fig. 13.—Nos. 1402-1415, Southern.

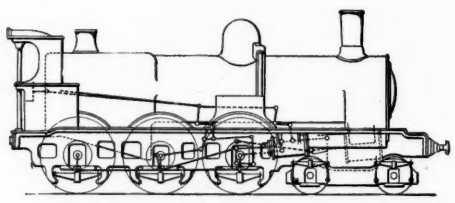

Fig. 14.—Nos. 1303-1312, Southern.

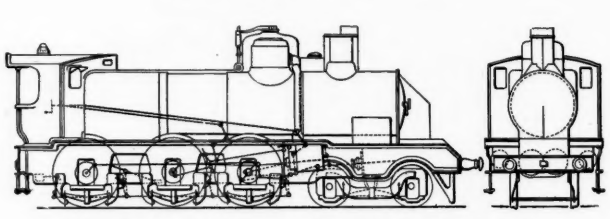

Fig. 15.—Nos. 3401-3550, Paris-Lyons & Mediterranean.

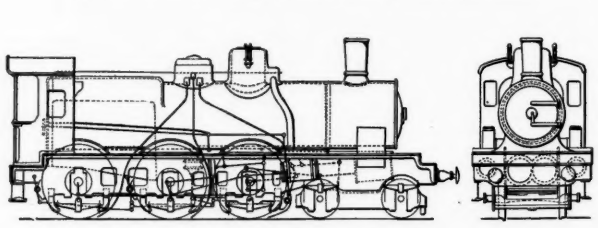

Fig. 16.—Nos. 3401-3450, Eastern.

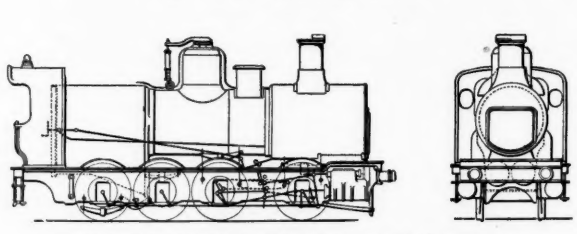

Fig. 17.—Nos. 4521-4530, Paris-Lyons & Mediterranean.

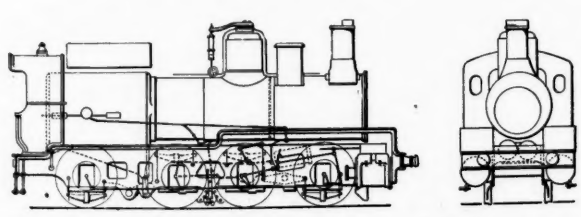

Fig. 18.—Nos. 3211-3260, 3301-3362, Paris-Lyons & Mediterranean.

Some Recent Types of Locomotives Used on French Railroads.

cylinders should always be at least from 40 to 50 per cent. of the stroke, and later for higher speeds. On the Paris-Lyons-Mediterranean the reversing shafts are, on the contrary, actuated at the same time, so that they always take the same fixed relative position.

In order to give the engines a sufficient starting effort, a special valve permits the direct admission of steam from the boiler into the receiver, where a safety valve limits the pressure. When the two connecting rods situated on the same side of the engine are opposite one another, or at 180° (the outside for the high-pressure cylinder, the inside for the low-pressure cylinder), the starting effort is not sufficient in certain positions of the engine, on account of the counter pressure upon the small piston of the steam admitted to the receiver; it has been found necessary to place between the two groups of cylinders special starting apparatus. It consists of a large cock which can interrupt the passage from the small to the large cylinder, and which opens at the same time a direct escape for the small cylinders. A similar cock exists on each side of the engine. The opening of this cock transforms the locomotive to a simple four-cylinder engine; in case of injury to one group of cylinders, it renders possible working with the other group only. The system of the Eastern consists of a special box furnished with a flap valve, which serves to separate the high-pressure and low-pressure cylinders, and a valve which opens a direct escape for the former. This apparatus receives the exhaust pipes from both high-pressure cylinders.

order a longer time. It is well known to what rapid wear very powerful locomotives with two cylinders are exposed, because it is scarcely possible to give to the wearing parts sufficient bearing surface. In practice, the cost of maintenance does not appear greater with four than with two cylinders from this reason. The arrangement of four cylinders, whilst preserving the coupling of driving axles, leads to a balancing of the moving parts. The oscillations of the locomotives and the variation of the weights upon the rail are reduced. In one example, given by M. Baudry, Chief Engineer of the Paris-Lyons-Mediterranean, the additional weight upon each wheel due to speed was only from 1 1-16 to 1 3-16 ton instead of 3½ tons for locomotives with two driving axles, and from 1⅜ to 2½ tons in place of 6½ tons for locomotives with three driving axles, the wheels being 4 ft. 11 in. in diam.

If compound locomotives with four cylinders cost a little more than ordinary two-cylinder locomotives, this excess is largely compensated for by economy in fuel, because the cost of maintenance and repair does not appear to increase. The observations made upon locomotives 501 and 502 of the Western, which have been in service for some years, confirm these favorable opinions. These two machines have been compared with eight equivalent two cylinder locomotives of the series 900. Care has been taken to put them to various duties, to employ exactly the same kind of fuel for all the engines, and to change the men often. The two compounds, compared with the other engines, have shown an economy in coal of

partment stores and their suburban customers. By this plan, the shop or person who is to send the parcel to the station checks it and gives the coupon to the person who is to claim it there. At the station the check is numbered only so as to show where it is put. Doubtless the shopkeepers pay the expenses.

Eastern Maintenance of Way Association Meeting.

Last week (page 620) we published a report of the first session of the eighteenth annual convention of the Eastern Maintenance of Way Association, held at Saratoga Springs, N. Y., Sept. 19, 20 and 21, with a list of the exhibits of railroad supplies.

After the election of officers Wednesday morning, a committee report was read on "Recent Improvements in Handling Snow; What Has Been the Result of Equipping Locomotives With Any of the So-Called Snow-Flanging Devices? Would It Be Advisable to Maintain Such Equipment for Light Flanging or, Economy and Efficiency Considered, Would the Regular Heavy Plows Best Be Used for All Snow Work?"

The committee holds that the prevention of blockades and the general handling of snow probably will depend in the future, as in the past, on the use of push plows driven by one or more engines as the case may demand. Such plows should be fully equipped with the most ap-

TABLE II.—PRINCIPAL DIMENSIONS OF FOUR CYLINDER COMPOUND LOCOMOTIVES.

Locomotives with Two Driving Axles.

Fig. No.	Road.	Numbers of the Series.	Boilers. Internal Diameter, Ins.	Boilers. Height of Axis Above Rail, Ins.	Boilers. Pressure, Lbs.	Tubes. Length Between Plates, Ft., Ins.	Tubes. External Diameter, Ins.	Tubes. Number.	Grate Area, Sq. Ft.	Heating Surface, Sq. Ft.	Cylinders. High-Pressure. Diameter, Ins.	Cylinders. High-Pressure. Stroke, Ins.	Cylinders. Low Pressure. Diameter, Ins.	Cylinders. Low Pressure. Stroke, Ins.	Diameter of Driving Wheels, Ins.	Weight in Working Order. Total, Tons.	Weight in Working Order. Adhesive, Tons	Remarks.
1	Northern	701	48 5/8	84 11/16	156	11 8 1/4	1 3/4	204	24 7/16	1109	13	24	18 1/8	24	82 1/16	37.20	27.16	Low-pressure outside cylinder.
	"	2121-2122	49 5/8	88 9/16	199	12 9 1/2	2 1/4	94	21 1/16	1671 7/16	13 3/8	25 1/8	20 7/8	25 1/8	83 7/8	47.04	30.02	
	"	2123-2137	49 5/8	88 9/16	199	12 9 1/2	2 1/4	94	21	1671	13 3/8	25 1/8	20 7/8	25 1/8	83 7/8	47.85	30.04	
2	"	2138-2157	49 7/8	88 9/16	213	12 9 1/2	2 1/4	94	21 7/16	1669 1/4	13 3/8	25 1/8	20 7/8	25 1/8	83 7/8	48.16	30.29	
	"	2158-2160	53 7/8	96 1/16	213	12 9 1/2	2 1/4	107	28	1891 7/8	13 3/8	25 1/8	20 7/8	25 1/8	83 7/8	49.66	30.52	
3	"	2161-2180	53 7/8	96 1/16	213	12 9 1/2	2 1/4	105	28	1862 1/4	13 3/8	25 1/8	20 7/8	25 1/8	83 7/8	51 57	31.89	
10	"	2641-2642	57 7/16	99 1/4	228	13 9 3/8	2 1/4	126	29 1/2	2274 1/2	13 3/8	25 1/8	22	25 1/8	80 1/8	62.99	32.48	Atlantic type.
4	Western	501- 502	51 1/8	88	199	12 5 5/16	2 1/4	88	21 5/16	1326 7/16	21 5/8	25 1/8	19 11/16	25 1/8	79 1/8	45.32	28 20	
5	"	503- 542	54 3/8	97 13/16	199	13 5 5/16	2 1/4	96	25 1/16	1439 7/16	13 3/8	25 1/8	20 7/8	25 1/8	79 1/8	48.72	30 51	
	State	2701-2706	49 7/8	88 9/16	213	12 9 1/2	2 1/4	94	22 1/16	1697 1/8	13 3/8	25 1/8	20 7/8	25 1/8	83 7/8	49.21	31 63	
	"	2801-2804	62 1/2	108 1/16	218	12 0 7/8	2	282	25 5/8	1903 7/8	13	28 1/8	22	26 1/8	84 1/4	54.02	31.56	Vauclain system.
	Paris-Orleans	1- 20	54 1/4	96 1/16	213	12 9 1/2	2 3/4	111	26 1/2	1890 5/8	13 3/4	25 1/8	21 5/8	25 1/8	82 1/16	.....	.....	Tenbrink heater in fire-box.
6	Southern	1701-1714	49 5/8	88 9/16	199	12 9 3/8	2 3/4	94	21 3/4	1635 5/8	13 3/8	25 1/8	21 7/8	25 1/8	83 7/8	50.00	31.30	
	"	1751-1774	54 3/8	96 1/16	199	12 9 1/2	2 3/4	111	26 1/2	1-8814 6	13 3/4	25 1/8	21 5/8	25 1/8	83 7/8	53.15	32.28	
	"	1775-1784	54 3/8	96 1/16	213	12 9 1/2	2 3/4	111	26 1/2	1865 7/8	13 3/4	25 1/8	21 5/8	25 1/8	83 7/8	.....	.....	
	Paris-Lyons	1	49 5/8	88 9/16	213	13 2 7/8	1 13/16	185	26	1281 1/2	12 3/8	24 3/8	19 11/16	24 3/8	78 3/4	52.66	29.13	Carrying axle at each end.
	and	C 2	49 5/8	88 9/16	213	13 2 7/8	1 3/4	224	26	1391 3/4	12 3/8	24 3/8	19 11/16	24 3/8	78 3/4	52.66	29.13	" " "
	Mediterranean	C 3	52	88 9/16	213	9 10 1/8	2 5/16	133	26 5/8	1594 1/16	13 3/8	24 3/8	21 1/4	24 3/8	78 3/4	44 27	29.89	Carrying axle in front.
	"	C 11-12	52	88 9/16	213	9 10 1/8	2 5/16	133	26 5/8	1594 1/16	13 3/8	24 3/8	21 1/4	24 3/8	78 3/4	47.16	29.67	
	"	C 21-60	52	88 9/16	213	9 10 1/8	2 5/16	133	25 5/8	1593 7/8	13 3/8	24 3/8	21 1/4	24 3/8	78 3/4	49.80	31.30	
8	"	C 61-150	56 1/16	97 1/4	213	11 1 3/16	2 5/16	150	26 7/8	2039 5/8	13 3/8	24 3/8	21 1/4	24 3/8	78 3/4	.....	.....	
9	Eastern	2401-243 Q	57 1/16	101 15/16	228	11 1 3/16	2 3/4	140	27 1/8	1988 5/8	13 3/4	25 1/8	21 5/8	26 1/8	79 1/2	58.29	33.24	Pressure reduced 213 lbs. per sq. in.

Locomotives with Three Driving Axles.

11	Northern	3121-3170	54 3/8	95 1/4	213	13 5 7/16	2 3/4	107	25 3/16	1945 1/16	13 3/4	25 1/8	21 5/8	25 1/8	68 7/8	57.65	41.80	
12	Western	2501-2525	56 1/16	94 7/8	199	14 1 1/16	2 3/4 & 1 3/4	117	26 1/8	2088 1/4	13 3/4	25 1/8	21 5/8	25 1/8	67 1/16	57.48	40.84	113 ribbed tubes 2¾ in. in diameter and 4 smooth [tubes 1¾ in. in diameter.
	Paris-Orleans	1701-1725	54 3/8	95 1/4	213	13 5 1/16	2 3/4	107	25 5/8	2023 3/8	13 3/4	25 1/8	21 5/8	25 1/8	68 7/8	.....	.....	
	Southern	1301-1302	54 3/8	95 1/4	199	13 5 1/16	2 3/4	111	26 1/16	1953 1/16	13 3/4	25 1/8	21 5/8	25 1/8	68 7/8	56.59	41.04	
14	"	1303-1312	54 3/8	95 1/4	213	13 5 1/16	2 3/4	111	26 1/8	1956 1/16	13 3/4	25 1/8	21 5/8	25 1/8	68 7/8	59.15	43.60	
	"	1401	54 3/8	92 3/8	199	13 5 1/16	2 3/4	111	26 1/2	1953 1/8	13 3/4	25 1/8	21 5/8	25 1/8	62 1/2	55.61	40.06	
13	"	1402-1415	54 3/8	92 3/8	213	13 5 1/16	2 3/4	111	26 1/8	1956 1/16	13 3/4	25 1/8	21 5/8	25 1/8	67 1/16	58.96	43.41	
	Paris, Lyons &	3261-3300	55 1/16	88 15/16	213	9 10 1/8	2 5/16	139	26 3/8	1665 5/8	14 3/16	25 5/16	23 1/4	25 5/16	59 1/16	57.19	43.32	Converted engines.
15	Mediterranean	3401 3550	56 1/16	95 1/16	213	11 1 5/16	2 9/16	150	26 1/16	2039 5/8	13 3/8	25 5/16	21 1/4	25 5/16	64 1/16	.....	.....	
16	Eastern	3425-3450	57 3/4	96 1/16	228	13 5 1/16	2 3/4	130	27	2210	13 3/4	25 1/8	21 5/8	25 1/8	68 7/8	64.34	46.35	Pressure reduced to 213 lbs. per sq. in.

Locomotives with Four Driving Axles.

	Northern	4101-4120	58 3/16	80 11/16	142	13 5 3/8	1 15/16	199	22 3/8	1338	15	25 5/16	26 1/16	25 5/16	51 3/16	51.97	51.97	Tandem cylinders.
	Paris, Lyons	3201-3202	55 1/16	88 15/16	213	14 3 1/4	1 5/16 & 1 3/4	307 & 247	26 3/8	1773 3/16 and 1667 1/4	13 3/8	25 5/16	21 1/4	25 5/16	59 1/16	56.00	56.00	One engine 307-1 5/16 in. tubes. Other has 247-1¾ in
	and	4301-4302	59 1/16	88 15/16	213	13 0 7/16	1 15/16 & 1 5/16	247 & 210	23 3/4	1777 7/16 and 1626 11/16	14 3/16	25 7/16	21 1/4	25 5/16	49 5/8	56.20	56.20	One engine 247-1 15/16 in. tubes. Other, 210-2 1/16 in.
18	Mediterranean	3211-3260	55 1/16	88 15/16	213	9 10 1/8	2 9/16	139	26 3/8	1665 5/16	14 3/16	25 5/16	23 1/4	25 5/16	59 1/16	52.86	52.86	
18	"	3301-3362	55 1/16	88 15/16	213	9 10 1/8	2 9/16	139	26 3/8	1665 5/8	14 3/16	25 5/16	23 1/4	25 5/16	59 1/16	52.86	52.86	
	"	4501-4510	59 1/16	88 15/16	213	9 9 7/8	2 9/16	184	22 5/8	2175	13 3/8	25 5/16	20 7/16	25 5/16	51 3/16	50 69	50.69	Converted locomotive.
	"	4511-4526	59 1/16	88 15/16	213	9 10 3/8	2 9/16	184	23	2175	13 3/8	25 5/16	20 7/16	25 5/16	51 3/16	50.10	50.10	" "
	"	4521-4530	59 1/16	88 15/16	213	9 10 3/8	2 9/16	184	22 5/8	2183	13 3/8	25 5/16	20 7/16	25 5/16	51 3/16	50.85	50.85	" "

If the two cranks for the high and low-pressure, instead of being opposite each other, are constructed with a suitable angle, a sufficient starting effort in all positions of the engine may be obtained without special starting apparatus other than the admission valve direct to the receiver. This was done on the first locomotives of the Paris-Lyons-Mediterranean, but this arrangement, which does not balance the weights of the parts so well, has been abandoned in recent designs.

For the lubricating of pistons and valves, the best apparatus consists of a kind of oil pump, set in motion by the locomotive gear. This pump distributes oil to the four cylinders in precisely regulated quantities.

The preference given in France to four-cylinder compound locomotives appears justified. In the first place, when a very great power of the locomotive is required, the compound system permits the use of steam at a high pressure (199 to 228 lbs. per sq. in.), whilst preserving simple distribution and ordinary valves. The system gives economy of steam, or a larger power for the same expenditure, and when the engine has to be driven hard, this economy increases, because the boiler is less forced. In addition to this, compound locomotives with four cylinders have certain advantages over those which have only two or three. Each cylinder, producing only a small fraction of the total work, the engines are less strained and remain in good

12 per cent. This economy would have been greater if the total amount used by engine 502 had not been always greater than that of engine 501, due no doubt to some small hidden defect. The cost of oil has not been greater for these compounds than for other locomotives.

With regard to wear, the types of locomotives 501 and 502 have run about 36,000 miles between each returning, whilst the other locomotives have run about 32,000 miles; the removal of the wheels is the occasion of a slight general repair to the mechanism. The wear of the valves is considerably less with the compound locomotives, in spite of the high pressure in the boiler (199 lbs. per sq. in. in place of 171 lbs.) The valves of the eight ordinary locomotives have been withdrawn after running about 43,000 miles. The valves of the compounds have given the following services:

Locomotive 501, high-pressure valves, 134,000 and 206,000 miles; low-pressure valves, 193,000 miles for both.

Locomotive 502, high-pressure valves, 128,000 and 165,000 miles; low-pressure valves, 225,000 miles for both.

A plan by which packages may be sent to railroad stations and stored there for passengers who have not yet arrived has been introduced in Hamburg and Altona, and would, it seems, be very welcome in this country to de-

proved forms of wings and flanges, so that in passing over the road a clear passage is left for any trains.

When the road is opened after a snow fall, much trouble is frequently experienced, particularly in level countries, by the wind forming shallow drifts over the rails, causing trains to lose time, or reducing the number of cars hauled, either meaning expense and delay. In such cases a flanger attached to the engine and operated from the cab by the engineer, or attached to a box car and drawn in the train serves a useful purpose.

Much depends upon the locality, as devices used successfully in some parts of the country fail to perform the required work in others where conditions are entirely different. The members of the committee were: A. C. Stickney, B. & M.; C. S. Osgood, N. Y., N. H. & H., and A. J. Logan, M. C.

In the discussion, which was not concluded until the afternoon session, C. B. Lentell, B. & A., told of the methods of handling snow on the Boston & Albany. For snow up to 6½ ft. deep, a combination plow and scraper, pushed by an engine, is used. The plow adopted as a standard, one of a number built by the road, consists of a flat car with the plow and a house on one end. This, in connection with the flanger run at frequent intervals, keeps the road open. For heavy snowfalls a large Russell plow is used. Several members de-

scribed various ways of giving warning when approaching crossings and stations, etc., and for signaling the engineer. Often it is impossible for the engineer to see ahead because of flying snow. On the Boston & Albany a cord is attached to the whistle of the locomotive and run forward to the plow, where it is worked by the conductor. On the Boston & Maine, and other roads, these signals are given by a bell on the plow. Relative to equipping locomotives with flanging devices, it was decided that under some conditions they are desirable, but that they should be worked by a third person, the contention being that the engineer and fireman have all they can do when fighting snow to attend to their regular duties. Several kinds of markers for indicating crossings, switches, etc., were described, but it was not decided as to what particular form was best. As to the location of the markers it was thought that those placed so as to be seen from the left side of the plow, where the view is less obstructed in a storm, are preferable. The report was finally adopted as read.

The paper by L. Curtis, B. & M., on "To What Extent Should Landscape Gardening Be Applied to Maintenance of Way Work?" an abstract of which appeared last week, was adopted with little discussion. The Boston & Albany employs a landscape gardener who has under him a special force and, as a rule, he has absolute authority over the station grounds, the grounds being taken care of by the station agents. Shrubs are used extensively; few plants are set out.

The report of the committee, consisting of G. L. R. French, B. & M.; C. B. Lentell, B. & A., and G. A. De More, N. Y., N. H. & H., on "From a Maintenance of Way Standpoint, the Consideration of the Relative Merits of Stone Ballast and Gravel Sprinkled With Oil" (continued from 1899), was read. Mr. De More submitted a minority report, and as the two documents differed widely, and the meeting divided as to which recommendation was the better, no conclusions were reached, the reports being received as information. From the discussion, it appeared that the majority of the members present preferred a gravel ballast, provided good coarse gravel, which is evidently scarce in New England, could be obtained. For stone ballast, the best size of stone is what will pass through a ring about 2 in. in diam. Some preferred about 6 in. of stone ballast that would pass a 2½ in. ring, with a top layer of stone that would go through a 1½ in. ring. The discussion led to oiling roadbed and as to whether or not ties were preserved by the oil. Very little information on the subject of oiling was given. Mr. Stickney, who has had considerable experience with oiling on the Boston & Maine, stated that it costs about $200 to oil one mile of double track. The track is sprinkled once a year—in June. He prefers an unoiled gravel ballast because dust is bound to fly and he takes it for granted that those who travel over the road prefer this dust to the chance of having their clothing spotted by oil-soaked dust. Where tie plates are used, no oil gets into that part of the tie under the rail; in the absence of tie plates some oil gets under the rail through the spike holes, but as the tie is worn out by the action of the rail rather than through natural rotting of the wood, the question of the preservative qualities of oiling is of no importance. The discussion brought out the interesting fact that spikes were more easily removed from ties sprinkled with oil. The oil follows the course of the spike into the wood.

On Wednesday evening Mr. W. M. Camp addressed the convention on the subject of track.

The third and last meeting was called to order Thursday morning at 9:50 o'clock, when the paper by Walter G. Berg, Chief Engineer of the Lehigh Valley, on "The Education of Railroad Men for the Subordinate Ranks of the Maintenance of Way Service," was read. An abstract of this was printed last week. A vote of thanks was extended to Mr. Berg.

The committee on "Are Flangeless Driving Wheels on Locomotives Desirable?" (M. C. Hamilton, N. Y., N. H. & H., Chairman; E. H. Bryant, N. Y., N. H. & H., and J. W. Shanks, N. Y., N. H. & H.) failed to make a report. In an informal discussion on the subject very few positive opinions were expressed; but those who spoke preferred to widen the gage on curves, to accommodate locomotives with all tires flanged, because of the liability of injury to the track through derailments caused by the dropping of blind tires. Several cases of accidents of this kind were cited.

The committee on "The Best Method of Constructing and Maintaining Public and Private Crossings at Grade" (Henry Ware, B., R. & P., Chairman; J. L. Shanks, Fitchburg, and R. A. McQuaid, B. & A.) made no report. R. P. Collins, N. Y., N. H. & H., also failed to submit a paper on "The Best Method of Training Section Men for Foremen."

The time and place for holding the next convention is to be decided by the Executive Committee; the former through letter ballot to the members. Those at the meeting preferred some point near Buffalo, N. Y., so that the members and guests could attend the Pan-American Exposition in a body.

Resolutions were passed extending votes of thanks to the Boston & Albany, Boston & Maine and Delaware & Hudson railroads for courtesies extended to members of the Association; to the management of the Grand Union Hotel, Saratoga; to representatives of manufacturers of railroad supplies who lent their support to the success of the meeting; to the representatives of the technical and local press; to Messrs. W. M. Camp, Walter G. Berg and L. Curtis for the interesting and instructive papers presented, and to the officers of the Association and members of the Executive Committee.

The entertainment features of the convention included carriage drives, seats at the theater and a trip to Lake George.

Special Apprentices.

Prof. Goss, of Purdue University, at the last meeting of the Western Railway Club, in discussing the subject of the railroad special apprentice, doubtless gave the true reason why but a few of the best technical graduates enter railroad shops as apprentices and what follows will be of interest generally to mechanical men.

"The technical schools of this country are every year graduating thousands of men, and these thousands are being absorbed by the industries of the country, and are in a large measure the men who are doing what is being done to make our country so pre-eminently a manufacturing nation. Do the railroads want these men? I believe they do want them, but not many of them are going into railroad work. Many more, proportionately to the men engaged, are being absorbed by other industries than by the railroads, and the explanation of that it seems to me is that these graduates, being human, select what seems to them to be the most promising opening, a' other lines are more attractive to them than the openings which appear in the railroad service. Now why is that so, if it is so?

"I think there are several little things which are perhaps beneath that fact, and one is the notion of drubbing which the average railroad man, through his own experience and for other reasons perhaps feels that the apprentice must be subject to. My experience is that the average graduate of a technical school does not object to hard work, he does not object to being dirty, he does not object to anything that may be given him, so long as he sees there is an outcome, but he does object to drubbing for the sake of being drubbed; he does object to being dirty for the mere sake of being dirty. He does not find any pleasure in it. If he can see something ahead, then he is satisfied.

"The average age of the special apprentice is not less than 22 years when he begins. He enters college at 18 and finishes at 22; he serves three years apprenticeship before he begins to get a living wage; before he is 25 he does not earn enough to win his bread and clothe himself. On the other hand, he can go into a supply house, he can work up as a salesman, or can go into a manufacturing establishment and he is very soon able to support himself. A year as an apprentice in almost any manufacturing establishment, if the man is a good man, is sufficient to put him on a footing with that establishment which will enable him to earn a good living. It takes more than that to put him on a good footing in the railroad service, so the fact, it seems to me, is, that the railroads are not getting the best of the technical graduates. . . .

"I realize the fact that a railroad employs men for service; that it is not the province of a railroad to take men in and turn itself into a school so that those men may be turned out great men. But the technical graduate entering railroad service is capable of doing good work along a great many different lines, and can be called upon for a more varied service than can be given by the regular apprentice, and because of that fact, because of his ability to turn to one or the other thing, he is really of more value to the company employing him than would appear in the particular service which he may at any one time be performing.

"I do not know as I have made myself quite clear on this subject. To summarize what is in my mind, I can say that I have a feeling that railroads are not getting the best of the technical men. I believe that railroad service is of such a character as to demand that they have the best that there is. I wish that the matter might be so systematized with reference to special apprentices that the best men would be attracted to railroad service."

Long and Fast Railroad Runs.

Under the caption, Long-Distance Railway Runs, *The Engineer* (London) has published the following long and fast runs of British, French and United States railroads. The title chosen by our contemporary is misleading to Americans. The runs are short as runs, but long as run without a stop.

The tables given below are concerned solely with long-distance runs, of 100 miles and upwards. It will be seen that in this respect British railways stand a head and shoulders above their French and American contemporaries, for British express train services have not only a far larger number of such performances to their credit, but the runs themselves are of greater length, and the rates of speed at which they are accomplished average higher. It has been decided to treat only of runs performed in ordinary daily service, which means that a few English and French trains running once or twice a week—principally in connection with steamer sailings—are excluded. Falling within this category, for example, there are the North-Western Company's American boat specials, which run twice or thrice a week in either direction. These trains do not stop between Euston and Liverpool—Edgehill—accomplishing this distance of 193½ miles in 3 h. 45 min.; rate of speed 51.6 miles per hour. Again between Paris and Calais there are the runs of the Marseilles and Brindisi expresses, on Wednesdays and Fridays, respectively, omitted.

British Railways.

Length of run.	Between.	Number of times performed daily.	Quickest journey.	Speed, miles per hour.
Miles.			h. m.	
194	Padding and Exeter.....	3	3 43	52.2
158	Euston and Crewe.....	4	3 01	52.3
152½	Willesden and Crewe.....	6	2 57	51.6
143	Newport and Paddington.....	1	2 57	48.4
141¼	Crewe and Carlisle.....	10	2 44	51.6
138¼	Stoke and Willesden.....	1	2 48	49.4
133½	Euston and Stafford.....	1	2 42	49.4
131	Liverpool Street and N. Walsham	2	2 38	49.7
129¼	Paddington and Birmingham....	2	2 25	53.4
128	Nottingham and King's Cross..	1	2 26	52.6
128	Willesden and Stafford.....	5	2 27	52.2
124½	Newcastle and Edinburgh.....	7	2 23	52.2
124	St. Pancras and Nottingham....	3	2 23	52.0
123¼	Penrith and Crewe	1	2 17	53.9
121¾	Yarmouth and Liverpool Street..	1	2 50	42.9
120¼	Paddington and Worcester.....	2	2 15	53.5
120	King's Cross and Newark.....	4	2 17	52.5
118½	Paddington and Bristol.....	2	2 15	52.6
117¾	Carlisle and Stirling.....	2	2 18	51.1
117¾	Lowestoft and Liverpool Street..	1	2 45	42.8
112¾	Leeds and Carlisle.....	1	2 25	46.6
112	Peterborough and York.....	1	2 06	53.3
109½	Liverpool Street and Beccles....	1	2 30	43.6
107½	Waterloo and Bournemouth.....	2	2 06	51.1
107½	Limerick Junction and Dublin..	1	2 18	46.6
106¾	Paddington and Bath.....	6	1 58	54.2
106¾	Grantham and Malton.....	1	2 18	46.3
106	Bournemouth and Vauxhall.....	1	2 19	45.8
106	Leamington and Paddington....	1	2 05	50.8
105½	Crewe and Holyhead.....	2	2 05	50.6
105¼	King's Cross and Grantham....	14	1 57	54.0
105¼	Wigan and Carlisle	2	2 07	49.6
104	Waterloo and Christchurch.....	1	2 12	47.2
103¼	Glasgow (Central) and Carlisle..	2	2 10	47.6
103	Marylebone and Leicester.....	7	2 05	49.4
102¾	Grantham and Finsbury Park...	3	2 01	50.9
102¼	Carlisle and Glasgow (Eglinton Street)	1	2 15	45.4
100¾	Edinburgh and Carlisle.....	1	2 03.	49.1

Total runs, 107.

Note.—The up and down Killarney express of the Great Southern & Western Company of Ireland is shown in the official time-tables as running the 144½ miles between Dublin and Mallow Junction without stopping. As a matter of fact, this excellent train pulls up once, if not twice, for water. This nowise detracts from the credit of the performance—though it renders the two runs ineligible for our list—as the inclusive rate of speed, 48 miles per hour, is most praiseworthy.

America—United States Railways.

Length of run.	Between.	Number of times performed daily.	Quickest journey.	Speed, miles per hour.	Company.
Miles.			h. m.		
148	New York and Troy..	3	3 00	49.3	N. Y. Cen. & Hudson River.
143	N. York and Albany..	6	2 40	53.5	" "
143	Toledo and Elkhart..	2	3 00	47.6	Lake Shore & Mich.
132	Harrisburg and Altoona	7	3 00	44.0	Pennsylv'a.
117	Steubenville and Newark	3	2 51	41.0	"
117	Tyrone and Harrisburg	1	2 53	40.5	"
117	Chicago and Logansport	2	3 00	39.0	"
116.9	Altoona and Pittsburg	3	3 10	36.9	"
116.0	Wilmington and Jersey City	2	2 25	48.0	"
112.5	Pittsburg (E. Liberty) and Altoona	3	2 52	39.2	"
106	Alexandria and Charlottesville	6	2 31	42.0	Southern.
106	Alliance and Crestline	2	2 42	39.2	Pennsylv'a.
105.25	Philadelphia and Harrisburg	6	2 25	43.5	"
104	Port Jervis and Susquehanna	1	2 55	35.6	Erie.

Total runs, 47.

Note.—Many of the American runs are punctuated by conditional stops, but these are not reckoned.

The New York Central, and Pennsylvania, and Lake Shore companies, if not others, have adopted the "pick-up" water troughs.

French Railways.

Length of break.	Between.	Number of times daily.	Quickest journey.	Speed, miles per hour.	Company.
Miles.			h. m.		
185½	Paris and Calais Pier....	2	3 30	53	Northern
147½	Chartres and Thouars...	2	3 07	47.3	State Rys
143¼	Paris and Feignies.....	2	2 51	50.2	Northern
136½	Paris and Trouville.....	2	3 42	36.8	Western
124	Chartres and Saumur....	2	3 12	38.7	State Rys
119¼	Paris and Arras.....	1	2 10	55.0	Northern
112½	Belfort and Chaumont..	3	2 20	48.2	Eastern
107½	Paris and Chalons.....	2	2 11	49.2	Eastern
104	Calais Pier and Amiens.	1	1 57	53.3	Northern
103¾	Paris and Troyes.....	6	2 07	49.0	Eastern
102	Calais Town and Amiens	2	2 02	50.1	Northern

Total runs, 25.

Several of the French runs enumerated must be taken with reserve. Only one company, the Northern, has adopted the pick-up water troughs, and these have only recently been laid down on the Paris-Calais main line, near Abbeville, in order to admit of the English boat expresses performing this fine break of 185½ miles. Therefore it is extremely doubtful whether the three runs that immediately follow are accomplished without an intermediate halt for water. However, in order to be scrupulously fair, the French railways are given the benefit of the doubt.

All three tables have been complied from the summer time-tables of 1900.

The Transportation Show at Paris.

We continue our translation and condensation from the pages of the *Journal des Transports* of its description of the show of locomotives at Paris.

The Western of France exhibits at Vincennes three powerful locomotives, two of them for fast express trains and the third for heavy trains running on a broken profile. Two of these locomotives were built by the company at its own shops, and the other was built at Creusot. One of these engines (Class 900) for fast express work, was shown by the company in 1899. The revision of that class, into Class 500, was made in 1899 and 1900.

The company, in its studies for engines of greater speed and power, designed a new bogie, carefully studying those in use in the United States and in England; and without pretending to have invented anything, it is believed that a bogie has been produced applicable to all future classes of engines which the company may build, and to several of those already in service. This bogie is characterized by considerable length, a disposition of the pivot somewhat back of the center of figure, and a lateral motion by sliding, regulated by springs. This style of bogie truck was shown for the first time by the company in the engine of Class 900 at the fair of 1889; and this is the same engine now exhibited at Vincennes. Meantime, it has run more than 310,000 miles without any other change or serious repair than replacing its smooth tubes by Serve tubes. Immediately after the exhibition of 1889, in special speed trials, this engine reached a speed of 105½ miles an hour, showing great stability.

This locomotive has two coupled axles, with equalizers, and the bogie truck described above; being, therefore, an American-type, eight-wheel engine. The drivers are 80.3 in. in diameter; the fire-box is deep, with a brick arch; the boiler, of steel; the grate surface, 21.5 sq. ft.; and the heating surface 132.83 sq. ft. The boiler pressure is 12 kilograms; the pistons are .46 meters diameter, .66 meters stroke. The engine weighs 14 tons on each driving axle and 16.5 tons on the bogie.

After the exhibition of 1889 the company built a series of these engines, two of the new engines being four-cylinder compounds, on the system of M. de Glehn. The governing consideration was not so much fuel economy (which is a variable element at best, according to the service in which the locomotive is running) but the company was much impressed by the important advantages of having the great power divided into four parts instead of two, giving much lighter parts for handling in repairs in the shops and even on the road. It was also evident that the divisions of the work into four periods for each revolution gave an extremely smooth running. Thus preserving all of the elements of stability of Class 900, the company proceeded to build the engines of Class 500 in 1889 and 1900. These have two coupled axles with equalizers, the drivers being 80.3 in. diam.; they have the leading bogie described above; fire-boxes not so deep, however, as Class 900, but with brick arch; boiler is steel, with Serve tubes; the grate area is 2.4 square meters, and the heating surface 133.9 square meters, and the boiler pressure is 200 lbs. The high pressure pistons are 13.4 in meters diameter and the low pressure 20.8 x 25.2 in. stroke. This engine has 15.8 tons on each driving axle and 18.4 tons on the bogie.

Apart from this engine, designed for extreme stability in very fast traffic, it was necessary to provide for heavy trains on lines of broken profile crossing many valleys almost at right angles, and the company brought out the tender engines of Class 2500, drawings of which are shown, and of Class 3700, one of which appears at Vincennes. The Class 2500 engine has three coupled axles, the drivers being 69 in. in diam., and has a good deal of similarity to recent 10-wheel engines of the Northern and Southern railroads, except that the Western company's special form of bogie is used. Equalizing levers are used between the axles. The fire-box is of medium depth and has brick arch; the boiler is steel, Serve tubes; grate surface, 25.8 sq. ft.; heating surface, 2,088.3 sq. ft.; boiler pressure, 200 to 213 lbs. The pistons are 13.8 in. high pressure, 21.75 in. low pressure, and stroke 25.2 in. The weight on each driving axle is 13.8 tons, and on the bogie 17.5.

The engine of Class 3700, as shown at Vincennes, has made 68.2 miles an hour. It also has three driving axles coupled, with four-wheel bogie forward. The drivers are 60.6 in. in diam. and the cylinders 18.1 x 23.6 in. This engine carries 14.6 tons on each axle and 15 on the bogie.

Mr. S. P. Bush on Brake Shoes.

At the last meeting of the Western Railway Club, Mr. S. P. Bush, who is Chairman of the M. C. B. Brake Shoe Committee, gave some reasons why more encouragement should be given to the development of high power brake shoes, and it would not be surprising if the specification for brake shoes which this committee is to present at the next Convention should set only the lower limits of the coefficient of friction without naming any maximums.

Mr. Bush said in part: "There is room for some discussion as to the maximum coefficient of friction allowable in a specification for brake shoes. We know that the friction is reduced with increase in speed and pressure, and so far as that goes it would seem desirable to keep down the brake shoe pressure. In other words, it would seem desirable if possible to obtain a brake shoe that gives us maximum friction with a minimum pressure. The shoe, developed on these lines, would certainly give a greater efficiency for retarding trains, particularly at high speeds. Further, with the constantly increasing load carried by cars, it is particularly desirable to keep down the braking pressure. We cannot very well reduce the pressure per square inch or per unit of area by increasing the size of the shoe. We have certain limitations there. On some roads it is the practice to use two shoes on the wheel, but that complicates the brake rigging; it would be exceedingly desirable if it were not necessary to have the brake rigging of the cars so heavy and so expensive.

"All these things lead me to believe that it would not be desirable to place a maximum limit on the coefficient of friction. It might be argued that it is necessary to do so for the reason that we have got to maintain the braking power on cars uniformly so that there shall not be too much variation. That is a thing that would be, while in one way desirable, almost impracticable to attain, for the reason that we have variable conditions otherwise that we cannot control. The difference in the lading of cars in the same train brings about much large variables than we would ever get from any difference in the friction of brake shoes.

"Again, from my experience, I do not believe that it is likely that any practical brake shoe will be developed immediately that will give a coefficient of friction much, if any, higher than the maximums that have been attained so far, and I think it is desirable to lend all influence that is proper in the direction of developing what might be called high power shoes. For the reasons that I have stated, I think they should be favored, and if we omit the maximum limit and leave the field open, I believe that those makers who are either in the business now or are prospective makers, or any one else with ideas on brake shoes would feel encouraged to work in that direction.

"One of the important things in connection with a good brake shoe is that the wear of the wheels should be reduced to a minimum. We know from our experience that some shoes wear the wheels much less than others. There is not the same cutting action with some brake shoes that there is with others, and it happens that those that have given the least cutting action have given the best coefficient of friction, at least from all appearances it would seem that the wear of the wheel, whether cutting or merely rubbing, is less. It is also a fact that some of those shoes that have performed in that way have also given very small wear of the shoe itself, and that is a further reason why I feel in favor of lending what influence is right in the direction of developing brake shoes having high frictional qualities."

The Taylor Electric Switch and Signal Apparatus.

The Taylor Signal Company, of Buffalo, which makes the electric interlocking machine mentioned in recent issues of the *Railroad Gazette* is now actively engaged in making at its shops, Carroll and Wells streets, Buffalo, the apparatus for a number of important switch and signal plants. The diagram shown herewith illustrates one of these plants, that at Lawrenceville, Ill.*

Electricity, from a 60-volt storage battery, is the power for all the functions in this interlocking, except the rail-circuits, which are worked by gravity batteries in the ordinary way. Current from the storage battery is used only while switches or signals are being moved, so that the consumption is very small; and at the plants thus far installed, some of which are of considerable size, the gasoline motor used to charge the accumulators is run only one or two days in a month.

The principal distinctive features of the Taylor system are:

1. The switch motor, for switches or derails.
2. The signal motor.
3. (At each switch or signal) A circuit closer to return an indication to the cabin when the switch or signal has finished its stroke.
4. Rail circuits to serve (where necessary or desirable) the same purpose as detector bars.
5. The interlocking machine, and insulated wires to connect it to switch and signal motors.

The switch motor is shown in Fig. 2. Through the gearing shown the motor *M*, turning 20 revolutions in about 1½ or 2 seconds, revolves wheel 1 one revolution to make one stroke of the switch. The switch is connected by rod 2, pivoted at *a* to cam movement, 3, revolving on pin *b*. Crank-pin *c* on wheel 1 besides moving the switch by means of the cam, moves the lock directly by rod 4, connected to the lock through 5 and 6. To the end of 6 (7) may be attached, if desired, a crank to work a mechanical detector bar. In the elevation a detector bar is shown. The lock bolt 6 is withdrawn from lock rod 9 before rod 2 begins its stroke, and it is reinserted after 2 has come to rest. The switch being locked, the final movement of the lock bolt causes the reversal of electric switch 10 which opens the power circuit and closes the indication circuit. The power for moving this circuit closer or switch is furnished by the spiral spring encircling its rod. The spring is compressed by the movement of rod 9 and, at the proper moment, by the final movement of lock bolt 6, is released so as to close 10.

The "indication" acting on the lever in the cabin, indicates to the signalman that the stroke of the track rails is completed, and permits him to finish the stroke of the lever; without this indication the lever would remain immovable; and as it is interlocked, where necessary, with any or all other levers, the clearing of conflicting levers is made impossible.

*Diagrams of two other interlockings, much larger, are shown in the advertising pages of this issue.

When a switch movement is completed and the motor circuit is broken the motor is at the same moment converted into a generator. This is done by closing the indication circuit (at 10) and this current, generated by the motor, lasting only a fraction of a second, is what gives the indication.

The movement of the switch back to its original position is accomplished by turning wheel 1 in the opposite direction, the movements of the cam being the same as before, but in reverse order. The polarity of the motor was changed (by the preceding movement) at 10. If a motor should run too long it is automatically thrown out of gear. For single switches or derailing switches a 1-h.p. motor is used, but the power required is usually only 7 amperes at 60 volts.

A signal motor is ⅛ h.p. It puts its signal in the all-clear position by winding up a chain which lifts the weighted end of the balance lever, pushing up the signal rod. This winding up requires about 2 amperes. When a signal has been put in the clear position a pole changer operates as at 10 on the switch machine, closing a circuit through a brake magnet to hold the signal down. The motor is at the same time de-energized. To return the signal to the stop position the brake magnet is de-energized and the counter-weight causes the blade to take the horizontal position. The brake magnet requires only .1 ampere.

Before proceeding to describe the machine and the connections to it we will turn to Fig. 1. This shows the arrangement of tracks and circuits at a plant employing 16 levers. Derailing switch 14 and signals 9 and 13 are shown on a larger scale in Fig. 5, in which *a* is the motor for the two signals, and *b* motor for derail 14; *c* and *d* are fixed to the post and one or the other, according to which circuit is closed, causes a hook to engage the rod for working the appropriate signal, thus performing a function similar to that of a mechanical selector. The circuit closer to open the motor circuit and close that to the electric brake is represented at *e*. At *f* are shown contact points inserted in the main wire, as an additional safeguard to insure that a high speed signal shall never be given with a facing-point switch or a derail open. When the switch or derail is closed the points *f* are closed by *g*. The pole changer is shown at *h*; *i* is the brake magnet and *j* is the track circuit battery.

In Fig. 6 *a* is the generator (or storage battery) for supplying current to the principal circuits; *b*, *c*, *d* and *e* are principal lead outs; *m*, *n*, *o*, *p* and *q* correspond with the same letters in Fig. 5; *r*, *r1*, *r2*, *r3*, *r4* are track relays. The connections to *r2* are shown at *r2 a* and *r2 b*, Fig. 1.

A front view of a small interlocking machine is shown in Fig. 10 and a rear view of two "levers," one for a switch and one for a signal, is shown in Fig. 7.

"Levers" (bars) with handles extending upward are for switches, and those with downward handles are for signals. The former, when moved, opens two circuits and closes two; the signal lever opens one and closes one.

The interlocking, which is mechanical, of the Johnson type is shown on the front of the machine in Fig. 10. The vertical tappets are actuated by the movements of a slot in the lever. See *s*, Fig. 11.

The "indication" acts by means of the solenoids *M* and M^1. When a switch (having completed its stroke) energizes one or the other of the pairs of solenoids *M* or M^1, Figs. 7 and 11, the movement of the armature *f* controls the bar *B*, supported by *L* and pivoted at *a*, Fig. 11. The armature *f* is rigidly fastened to the cores of the magnet.

In Fig. 11 the lever *L* has been pushed in about three-fourths of its stroke. The first part of the stroke, by the action of the upper left hand portion of slot *s* has depressed tappet *t* far enough to lock all conflicting levers. During the intermediate part of the stroke, while the pin of the tappet is in the horizontal portion of slot *s*, the lever *L*, through bars *B* and *r*, has changed the circuit closer or controller from the "reverse" to the "normal" position (using these terms in the sense common in interlocking practice). The controller being normal, it sends a current to the switch motor, changing the track-rails to normal. This being accomplished, the "indication," sent back from the switch, as before described, energizes magnet M^1. This attracts armature *f* and permits bar *B* to drop out of notch *h*, by which it moves bar *r*; the operator can then push *L* the remainder of its stroke, forcing tappet *t* farther down and thus unlocking such levers as it is proper to unlock after the movement of this switch. In case the indication should not come (as would be the case if the switch rails should fail to move "home") and *L* is pulled back towards the position from which it started, the pawl *d* engages the lug f^1 on the side of armature *f* and pushes the armature to the right; *d* is then lifted over f^1 by striking against another lug, *g*, extending downward from the frame. The pushing of *f* to the right prevents *B* from dropping without being released by an indication current. If there is a failure to indicate on this side also, and the operator makes a second attempt to move the switch by again pushing in *L* the dog d^1 will push *f* to the left. Bar *B* can never drop except after *M* or M^1 has pulled *f* out from under the point b^1 or *b*. It is possible to move the lever inward to the full extent of its stroke after having moved it partly outward, but it is impossible to move it through the last part of its stroke in either direction without getting a release by means of the "indication."

The dotted lines at *dd* indicate the position of bar *B* when it is disengaged from *r*. Rollers *m* and *n* support or guide the sliding bars. The function of the recess at *p* is to limit the motion of sliding bar *r*.

The movement of the switch in the opposite direction is

Fig. 6.

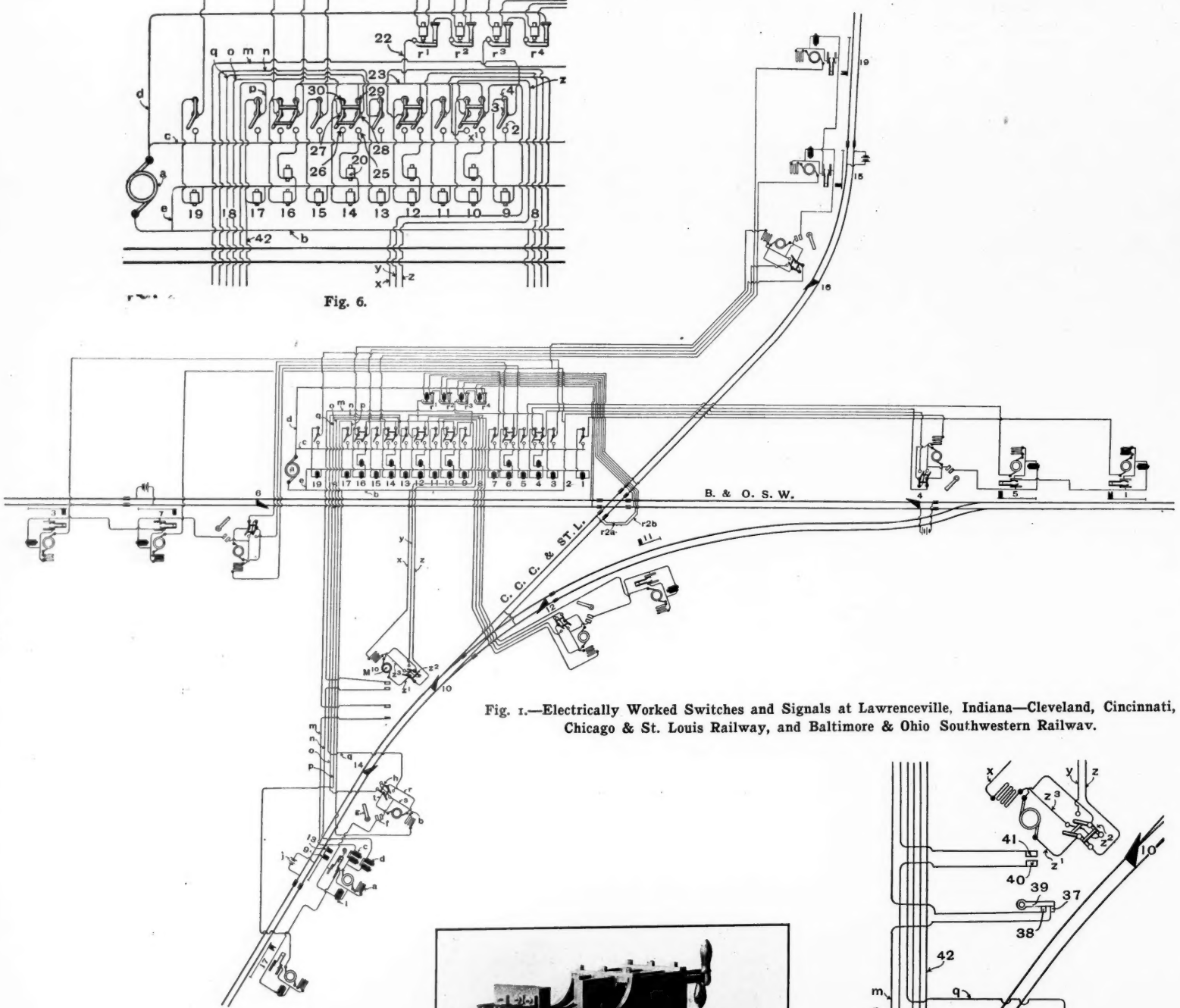

Fig. 1.—Electrically Worked Switches and Signals at Lawrenceville, Indiana—Cleveland, Cincinnati, Chicago & St. Louis Railway, and Baltimore & Ohio Southwestern Railway.

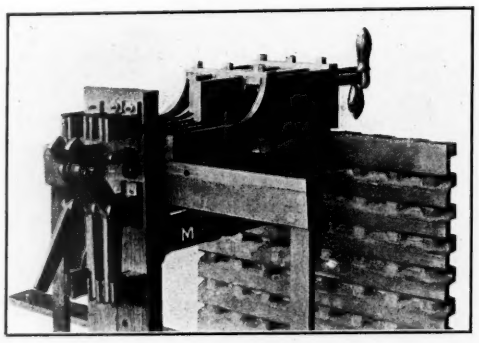

Fig. 7.—Part of Machine, Rear View.

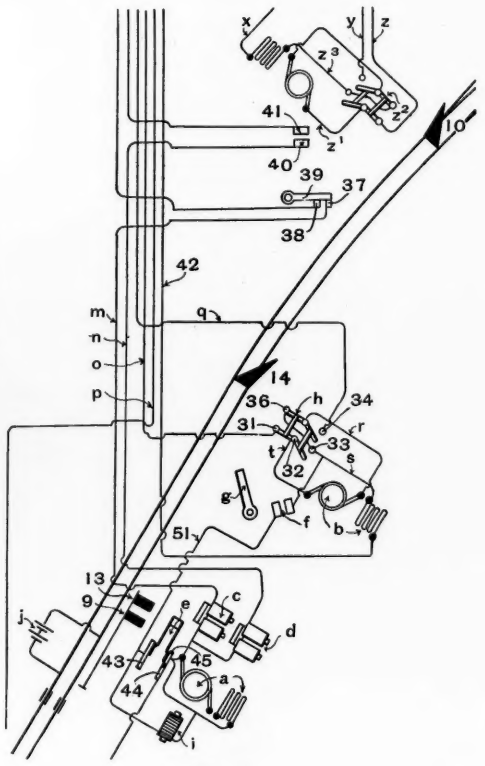

Fig. 5.

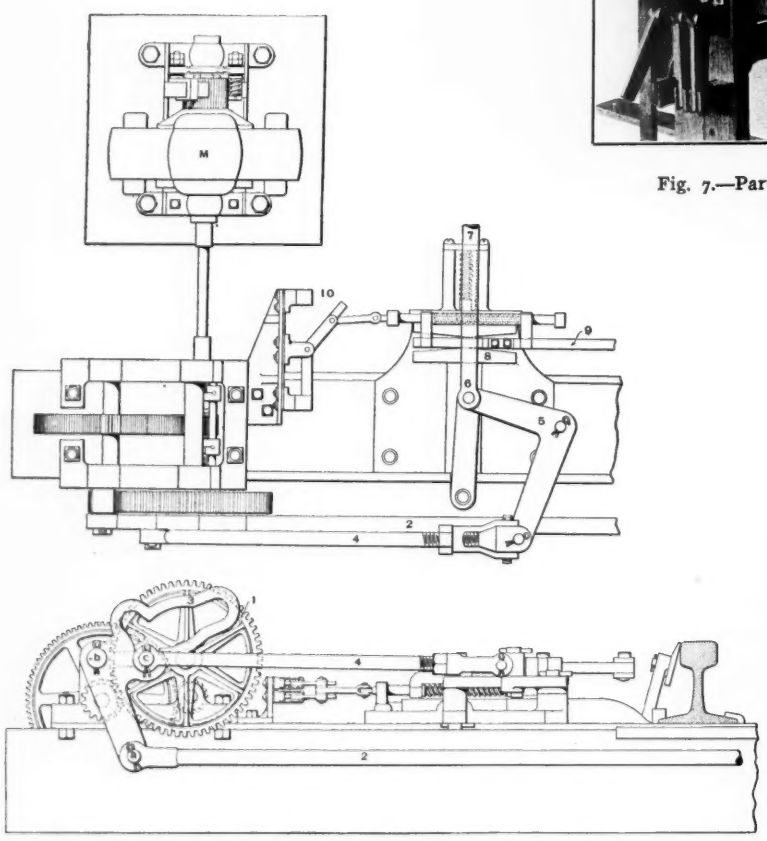

Fig. 2.—Plan and Elevation of Electric Motor for Switch.

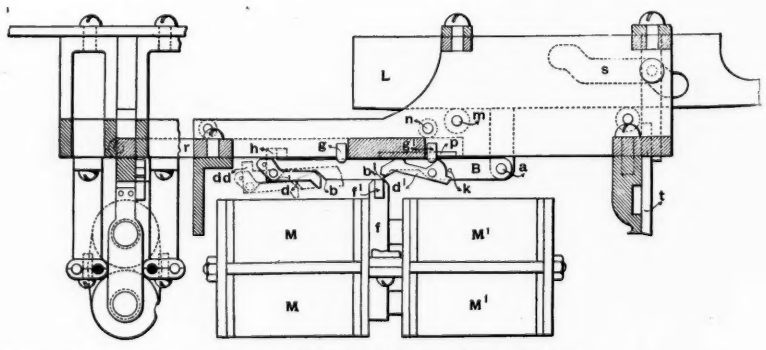

Fig. 11.—"Lever" of Interlocking Machine.

THE TAYLOR ELECTRIC SWITCH AND SIGNAL APPARATUS.

effected in the same manner as here described, but by pulling instead of pushing lever *L*.

The dwarf signal Fig. 9, is worked by a pair of solenoids *S*, *S*¹. These, being energized by a current from the

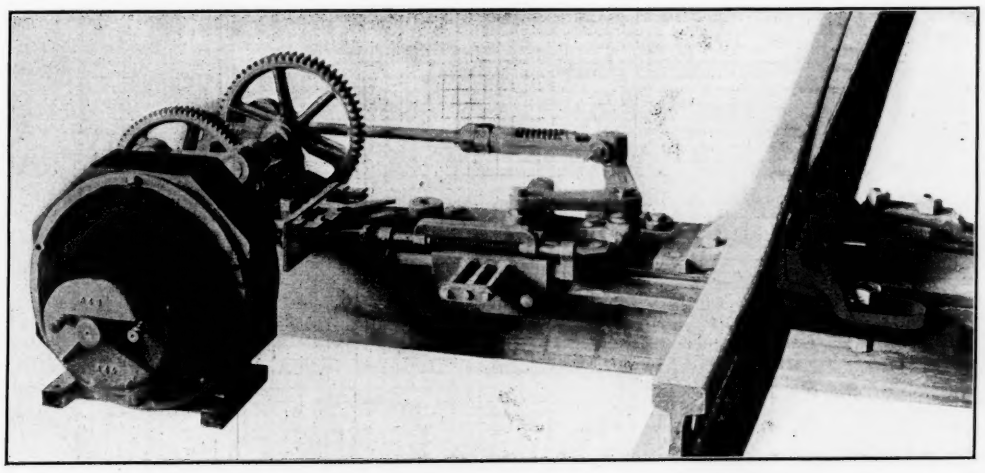

Fig. 3.—Switch Machine (Left Hand).
With cover off.

cabin, lift the connecting bar *B*, force up the signal rod *R* and clear the signal. A spring in the column, *C*, returns the arm to the horizontal position when the current is withdrawn. In this signal the indication current is closed by the contact points shown between the solenoids. Just before the signal reaches the clear position the low-resistance winding of the solenoid is automatically put in

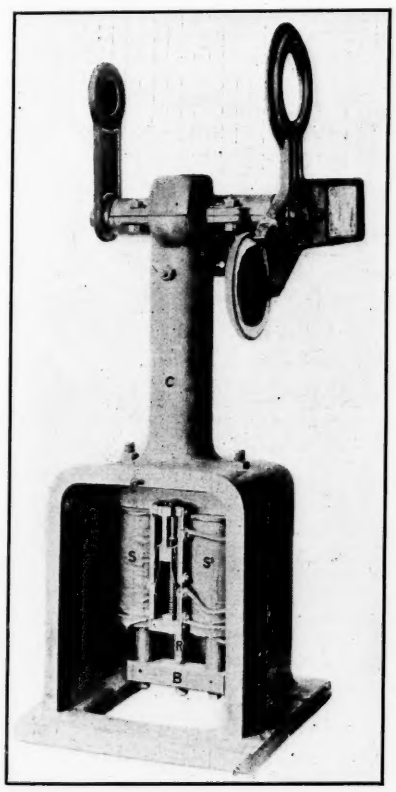

Fig. 9.—Dwarf Signal.

series with the high resistance, so that the signal is held at all-clear by ¼ ampere, although a current of six amperes was used to move it.

The arrangement of the connections between a lever and its switch or signal can be seen by an examination of Figs. 1, 5 and 6. Take, for example, switch No. 10. On closing the contact points at x^1 (lever No. 10) current from the supply *a* flows through wire *d*, forward stops and armatures of relays r^2 and r^1 (in series) contacts of circuit controller x^1, wire *z*, pole changer z^2 (Fig 5) motor of switch No. 10, wires *x* and 42 back to generator *a*. Motor M^{10}, being actuated, moves the switch. The movement of the switch changes the connection at z^2, so that the next movement of lever 10 will send a current through *y* instead of *z*.

The control of this lever by the rail-circuit is effected through track relay r^2, Fig. 6, which is actuated, through wires r^2a and r^2b (Fig. 1) by the circuit from battery *j*. The armature of r^2, when dropped, in consequence of the presence of a train on the track between *j* and the crossing, opens the circuit through which the signalman works switch No. 10.

Both the "normal" and "reversing" circuits of switch No. 10 are taken through the contacts of the relays r^1 and r^2 because a train may pass over this switch in either of its positions. Only the "normal" circuit of a derailing switch is taken through the relay contacts because a train is not to run over a derail when "normal" and it may be desirable to "reverse" it with a train on the track section.

The connections to switch 14 and the signal next to it may be traced in Figs. 5 and 6. To reverse switch No. 14, or in other words to set for the main track, lever 14 is reversed or pulled out which puts the arms 27 and 28, Fig. 6, in contact respectively with blocks 26 and 25. This closes a circuit from generator *a* through wire *c*, block 26, arm 27, wire *o*, contact block 31 (Fig. 5) arm 32, armature of motor *b*, arm 35, block 36, wire *s*, field coils of motor *b*, wire 42, back to generator *a*. When the switch is completely closed and locked the pole changer *h* is thrown over so that arms 32 and 35 are taken away from 31 and 36 and put into contact with the blocks 33 and 34 respectively. This closes a circuit from the switch motor to indication magnet 20, (Fig. 6) through wire *r*, arm 35, block 34, wire *q*, arm 28, block 25, magnet 20, wires *c* and 42 to field coils of motor *b*. This energizes the magnet 20 and releases latch *B* (see Fig. 11) so that lever 14 can be pulled to the end of its stroke. This final movement of lever 14 releases lever 9.

Reversal of lever 9 puts the arm of the electric controlling switch 3 (Fig. 6) into contact with block 2. This closes a circuit from generator *a* through wire *c*, block 2, arm 3, wire *m*, contacts 38, 39, 37, controlled by the rails of switch No. 10; it continues through wire *m*, magnet *e*, signal motor *a* and signal circuit controller *e*, wire 51, controller *f g*, operated by switch No. 14, wire *s*, field coils of switch motor *b*, wire 42, back to the generator *a*.

When the signal arm has moved to all-clear the circuit controller *e* is moved so that it no longer connects 43 and 45; but the above described circuit is shunted around this break by the brake magnet *i*. This holds the signal in the all-clear position as long as lever 9 remains reversed. The movement of the circuit controller *e* when the signal goes to clear, connects contacts 43 and 44, thus closing the circuit to the distant signal. This circuit thus depends on the home signal being clear.

When lever 9 is put back into its normal position arm 3 is put into contact with block 4. Then as the signal returns to its normal position the last part of the movement of the blade replaces circuit controller *e* so that it connects 43 and 45. This closes the circuit containing the signal motor *a* and the indication magnet 9 in the tower. The signal motor armature is rotated by the fall of the blade, and the current generated by this rotation flows through wire *m*, arm 3, block 4, magnet 9, wires *e* and 42, field *b*, wire *s*, points *f* and 43, circuit controller *e*, field coils of the signal motor *a* and back to the armature. This current serves the purpose of retarding the fall of the counter-weight of the signal and also of energizing the indication magnet 9 (Fig. 6) which releases the latch and permits lever 9 to be moved through the final portion of its stroke.

As before stated, the electric interlocking plants thus far installed have been run by batteries charged by gen-

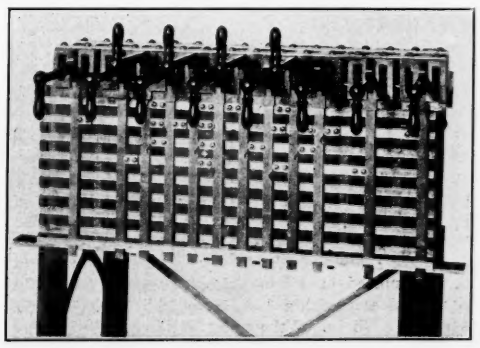

Fig. 10.—Front of Taylor Interlocking Machine.

erators run by gasoline engines. At one of these plants, that at Edgewood, Ill., on the Illinois Central, a record of the cost of maintenance for three years and six months shows an average of $10.62 a month, including one renewal of the storage batteries. In 1897 the average cost was $7.14 a month; in 1898 it was $2.18; in 1899, not counting the renewal of the storage battery, $3.17. The renewal of the battery, which was made in 1899, cost $254. The plant at Edgewood has 18 levers.

The Effect of Temperature on the Friction of Brake Shoes.

At the meeting of the Western Railway Club, Sept. 18, Prof. R. A. Smart, of Purdue University, presented a paper on the friction of brake shoes giving results of tests on the M. C. B. brake shoe testing machine under various conditions of pressure, speed and temperature. This paper was briefly referred to last week. The tests under the first two conditions confirm the conclusions from the M. C. B. laboratory tests of 1895 and 1896, that the co-efficient of friction of brake shoes increases with decreases of speed and with decreases of pressure. The Purdue experiments, however, are the first to give conclusive data as to the effect of temperature on friction. This conclusion is that within the limits of the tests the coefficient of friction of cast-iron brake shoes is practically constant with changes in temperature. Prof. Smart says, in part:

So far as the writer is aware, no reliable information has been obtained heretofore on the effects of temperature, a fact which is easily explained by the difficulties attending such investigations. In fact, it is well-nigh impossible to carry out the experiments with a great degree of refinement or to arrive at other than general conclusions. This, however, has been done in the investigation under consideration, and the general conclusion reached is put forth with confidence as one which is accurate for all practical purposes. The tests upon which the conclusion is based involve ranges of temperature of the shoe up to 1,500° Fahr., speeds of from 40 to 60 miles per hour, and normal pressures of from 2,800 to 6,840 lbs. They also involve continuous runs of about five miles in length and from five to 10 minutes in duration. It is believed that the range of temperature mentioned is sufficiently high to embrace all but the most extreme conditions of service. The term "temperature of the shoe," as here used, is more accurately defined as the temperature of two points on the center line of the face of the shoe and near either end. It is obviously impossible to measure the average temperature of the whole shoe while running. Two points of measurement, as just noted, were chosen to represent the average temperature of the shoe.

In Figs. 1 to 4 are shown, in graphic form, the results from four continuous tests. In these tests the wheel was run at a constant speed of about 40 miles per hour, and the brake shoe pressure was 2,808 lbs. Both shoe and wheel were cold at the start. Successive readings were taken, during the run, of the temperature of the trailing end of the shoe, and these are plotted with the coefficient of friction for the same instant. It will be seen that the curve of temperature of the shoe rises during the run to several times its original value, while the coefficient of friction changes but little. The curve representing the coefficient of friction does not, in these diagrams, start at the axis of ordinates. The readings obtained at the beginning of an application are always more or less irregular, and were, therefore, omitted when plotting the curves. The lines showing the coefficient of friction are not straight, but the variations are not greater than the variations found in ordinary stop tests under identical conditions. Their character and direction warrants the general conclusion which has been drawn.

In partial explanation of the peculiar form of the temperature line, it should be said that at no time did the shoe heat up uniformly over its entire rubbing surface. The point of maximum temperature during the first part of the tests, particularly, shifted from the center to either end and back again for no apparent reason and with no observable regularity. Readings taken from both ends in quick succession would sometimes show the leading end hotter and sometimes the reverse, although at any time the difference between them was not great. The general form of the temperature curve may be explained as follows: Immediately after the shoe is applied to the wheel its temperature rises to about 500° Fahr. In this time the wheel, being of greater mass, has remained practically cold. At this point the shoe begins to impart heat rapidly to the cold wheel, thereby keeping its own temperature down, until the wheel has been heated up and the tread has acquired a comparatively high temperature, after which the temperature of the shoe again increases.

In the continuous tests just described, the initial temperature conditions of the shoe and wheel were the same. Both were cold. To show that variation in the initial temperature does not lead to different results, reference is made to Fig. 5, which represents the results of 15 stop tests in which the wheel was brought to rest from a 35-mile speed under a continuous brake shoe pressure of 6,840 lbs. The initial temperature of the shoe varied from about 200° to 600° Fahr. The temperature of the wheel varied also, following approximately the temperature of the wheel. The tests were run in several series, each series consisting of three or four tests run after the other, the final temperature conditions of one being the initial conditions for the next, and so on. The conclusion drawn from these results confirms the one already stated, *i.e.*, that within the limits of the tests the temperature of the rubbing surfaces does not affect the coefficient of friction. A number of series of stop tests were made in addition to those the results of which have just been presented. The results from these tests were irregular and unsatisfactory and no conclusion could be drawn from them.

In order to measure the temperature of the face of the shoe during the application of the shoe to the wheel, use was made of special Le Chatelier pyrometers,* one in either end of each shoe. Each thermo-electric couple or

*Described in the *Railroad Gazette*, April 2, 1897.

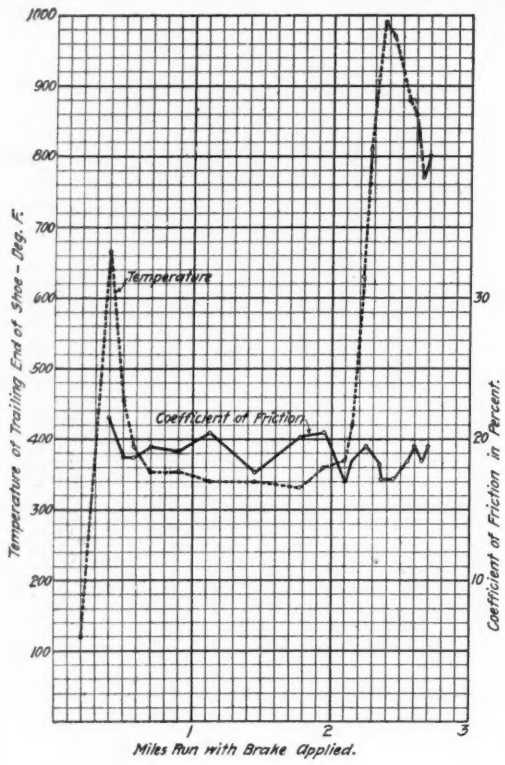
Temperature of Trailing End of Shoe - Deg. F.
Coefficient of Friction in Percent.
Temperature
Coefficient of Friction
Miles Run with Brake Applied.

Fig. 1.—Variation of coefficient of friction with temperature. Continuous run No. 1. Hard cast iron shoe. Chilled wheel. Speed, 40 M. P. H. Pressure 2,808 lbs.

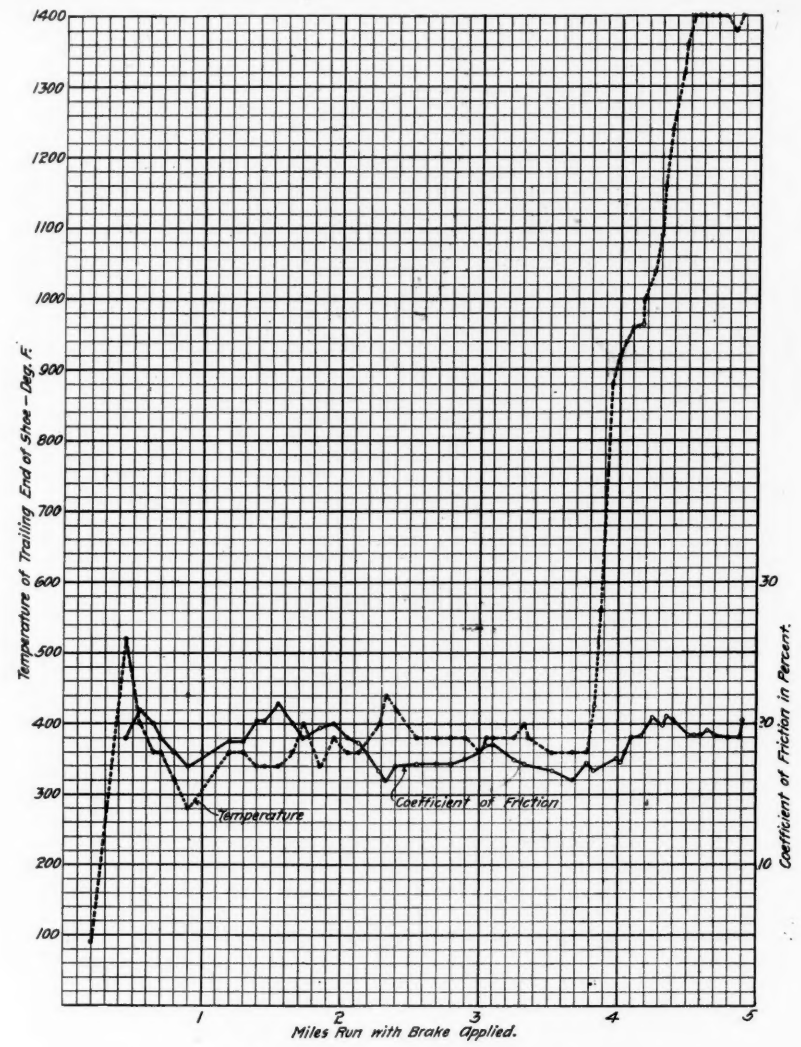
Temperature of Trailing End of Shoe - Deg. F.
Coefficient of Friction in Percent.
Temperature
Coefficient of Friction
Miles Run with Brake Applied.

Fig. 2.—Variation of coefficient of friction with temperature. Continuous run No. 2. Hard cast iron shoe. Chilled wheel. Speed, 40 M. P. H. Pressure, 2,808 lbs.

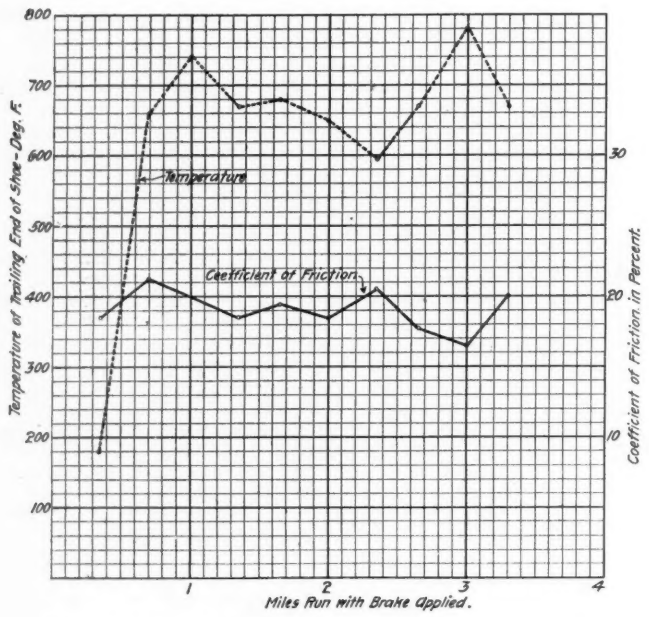
Temperature of Trailing End of Shoe - Deg. F.
Coefficient of Friction in Percent.
Temperature
Coefficient of Friction
Miles Run with Brake Applied.

Fig. 3.—Variation of coefficient of friction with temperature. Continuous run No. 19. Hard cast iron shoe. Chilled wheel. Speed, 40 M. P. H. Pressure, 2,808 lbs.

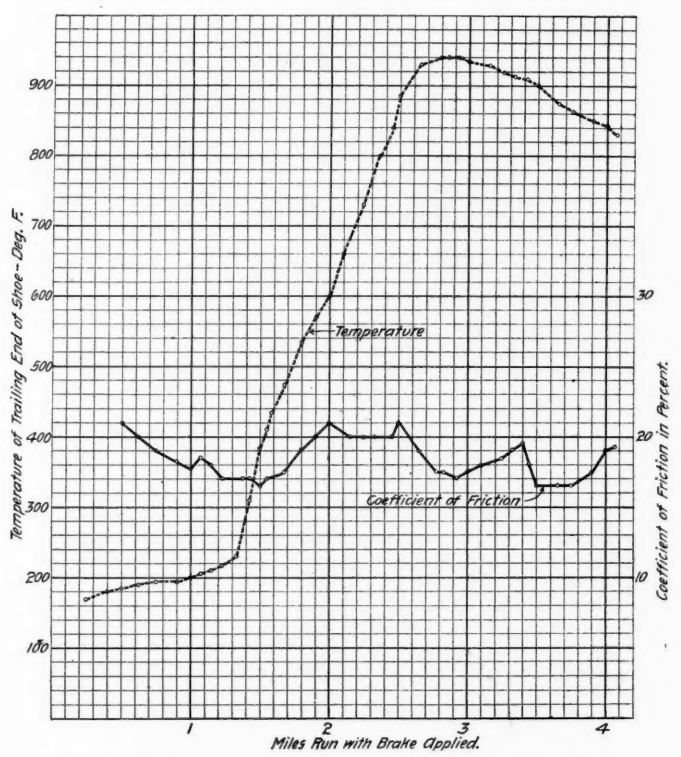
Temperature of Trailing End of Shoe - Deg. F.
Coefficient of Friction in Percent.
Temperature
Coefficient of Friction
Miles Run with Brake Applied.

Fig. 4.—Variation of coefficient of friction with temperature. Continuous run No. 26. Soft cast iron shoe. Chilled wheel. Speed, 40 M. P. H. Pressure, 2,808 lbs.

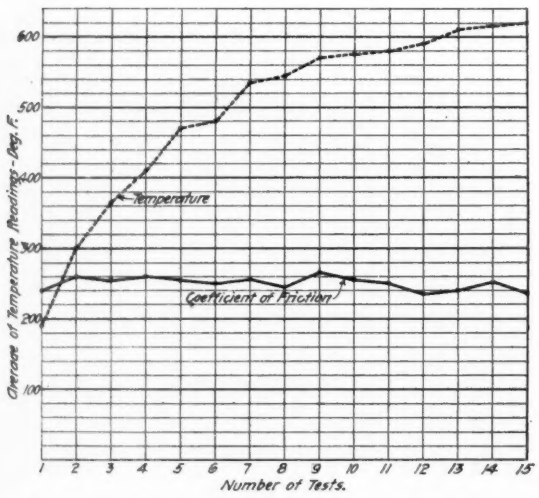

Fig. 5.—Variation of mean coefficient of friction with temperature. Soft cast iron shoe. Chilled wheel. Test arranged according to temperature. Initial speed, 35 M. P. H. Pressure, 6,840 lbs.

joint was placed in a hole drilled from the back of the shoe toward and within 1-32 in. of the face. The joint was within .005 in. of the point of the protective covering, thus bringing it very near the face of the shoe. Each joint was provided with a protective covering consisting of an inner tube of fire clay, wrapped with asbestos cord to retain the couple, one wire of which was outside and one inside of the tube, the whole covered with a tubular outer casing of porcelain and tipped on both ends with fire clay. Four joints were used in all, two for each shoe. Some trouble was experienced in preventing damage to the leading-out wires during the progress of the work. After trying several expedients a mould was made around the wires of a mixture of plaster of paris and asbestos which served the purpose well.

The measurement of the thermo-electric current was made by means of a D'Arsonval galvanometer fastened to the wall of the laboratory about 40 ft. distant from the testing machine. A mercury switch was provided by which the couple on either end of the shoe might be thrown in circuit with the galvanometer. In addition to the regular recording pencils used with the M. C. B. testing machine, an extra pencil, operated by an electro-magnet and push-button, was provided. The push button was placed in a convenient position near the galvanometer, so that the observer might indicate on the brake shoe machine record paper, the points at which temperature observations were made. The wheel was brought to the desired speed, 40 miles per hour, and the lever was then tripped, bringing the shoe in contact with the wheel at a

pressure of 2,808 lbs. Both shoe and wheel were cold at the start. The record paper was thrown in gear at the start and kept in throughout the test. The observer at the galvanometer took readings on one end of the shoe as frequently as possible, about every 10 seconds, making a mark on the record paper by means of the push button and electric current at every reading. It was not possible to take the readings at regular intervals, on account of the deflection of the galvanometer, which was not perfectly dead-beat. At the beginning and end of each run, temperature readings were made at both ends of the shoe to note the variation, if any existed. The tests were from five to eight minutes in duration.

Before using the Le Chatelier pyrometers, it was necessary to determine the deflection of the galvanometer for the different temperatures with which they were to be used. Since the length and character of the circuit between the joints and the galvanometer affects the total resistance of the current and, hence, the deflection of the galvanometer. it was necessary to calibrate the instrument with the same length of wire with which it was to be used. To this end, the permanent circuit was put up from the shoe on the testing machine to the galvanometer. This was then taken down and put up temporarily at another point which was more convenient for purposes of calibration.

The method of calibration employed was to place each joint in a liquid of known temperature and note the resulting deflection of the galvanometer. The substances chosen for this purpose were as follows: Water, up to 212° F.; mercury, up to 600° F.; zinc, melting point, 779° F.; aluminum, melting point, 1157° F., and potassium sulphate, melting point, 1859° F. While using the water and mercury, an accurate mercurial thermometer was used to observe the temperature of the liquid. The zinc, aluminum and potassium were melted with a special Chaddock burner. The substances were heated above the melting point, and the readings taken at the point of congealation. Separate crucibles were used for each substance. Trouble was experienced at the highest temperature with the cracking of the protective covering. For this reason, but one of the four points was subjected to this temperature. It was, however, deemed unnecessary to obtain the highest point in each case, in view of the fact that the calibration curve for each joint was a straight line.

In order to determine whether, with the joint in place in the shoe, a certain temperature of the face of the shoe would give the deflection indicated by the calibration curve, or, in other words, whether there was any "lag" in temperature between the face of the shoe and the point of the thermo-electric couple, the joints were put in place in the shoe and the latter was placed on a stand, face down, with a Bunsen burner under the middle of its face. Wax of a known melting point was melted and poured in a narrow line on the face of the shoe in the direction of its length. A similar line was made of sulphur, near the first. Two cross marks were made directly under each joint. The burner was lighted, and as the temperature of the shoe increased and the heat worked out to each end, the melting points of the wax and sulphur marks crept from the center toward each end. When these melting points reached the two cross marks, galvanometer readings were taken. It was found at first that quite a difference of temperature existed. By placing mercury in the holes surrounding the tip of the joints this lag of temperature was reduced to from 8° to 10° Fahr. The mercury was subsequently replaced by fine platinum filings, in view of the danger of the mercury alloying with the platinum of the thermo-electric couple.

An Epoch in Railroad Transportation.*

BY HENRIK V. VON Z. LOSS.

A structural car—contrasted with pressed steel—if made exclusively from standard shapes, will either have excessive dimensions or parts (meaning excessive weights if an abnormal number of rivets is to be avoided, in which case the uniform cross-sections of the parts exposed to flexure are represented by the one demanded at the weakest spot) or on the other hand, will have to be built up of a series of pieces, each and all riveted together, in which case a slight decrease in weight is secured by a large increase in rivets. It is clear to assume, from an engineering standpoint, that a car of this type is apt to represent more or less a compromise of the above two conditions, possessing hence some of the inherent faults of each.

By the introduction of the pressed-steel system, girders are made uniform in strength without waste of material and without rivets; corner pieces are avoided; stiffeners are made parts of the plates themselves through the introduction of ridges and depressions; and the general form and shape of the structure is regulated with a view of giving strength both locally, and as a whole, besides the accommodation of the lading. Experience has proved a difference of about 10 per cent. to 11 per cent. in favor of the pressed-steel car as compared to the one built up from standard shapes, and in cost, an equal decrease.

I wish to call your attention to certain assertions that have been made by representatives of the wooden car industry, who claim a natural superiority for wood as compared to steel, on the theoretical basis that for tension and flexure, and weight for weight, wood is the strongest material in the arts. The standard freight car material of to-day in the United States is southern yellow pine, which, in a thoroughly dry state, will weigh about 45 lbs. per cu. ft. It is well known that wood as used is more or less unseasoned, a fact which is quite proven by the shrinkage of joints of all wooden cars, after manufacture. Green timber weighs from one-fifth to one-half more than seasoned material, which means that a cubic foot of southern yellow pine may reach a weight as high as 65 lbs. Due to exposure to weather, a wooden car will always remain more or less unseasoned, and 50 lbs. per cu. ft. can safely be taken as a conservative figure. The Bureau of Building Inspection of the City of Philadelphia allows for a good yellow pine, when used as a girder, a maximum fiber strain of 1,500 lbs. per sq. in. This is probably a fair illustration of the allowance made for a safe wooden structure, when built of a material really superior to that generally used in car construction. Let us take the weight of steel plate as 490 lbs. per cu. ft., permitting in this same material when exposed to flexure, a working stress of about 17,000 lbs. per sq. in., a figure which is ordinarily allowed for bridge pins by reputable structural builders of to-day.

Summing up the matter, we find a proportion between the working stresses in the two materials of about 11½ to 1, while the relation between weights is about 10 to 1, the difference, between the above figures (1½ out of a total of 10, or equal to about 15 per cent.) representing superiority due to the use of steel. The above data refers to the relations which exist under static or semi-static loads. Where heavy shocks are encountered, such as occur in the operation of freight cars, strains ought in no instance to exceed about 13,000 lbs. for steel, and 1,100 lbs. for wood, resulting in proportions that are still more favorable to the steel structure: viz., 20 per cent.

In order to acquire some little idea as to the possible theoretical saving of weight in a steel car over one of wood, we must remember that the above-mentioned figures of 15 per cent. to 20 per cent., would mean just that much saved in a steel car, when compared to an equally strong wooden car of the same capacity, on the supposition only that equal increments in weight would also mean equal increments in strength. This assertion, however, holds good only for materials that are exposed to plain tension or compression, while with flexure, the relation is changed as exemplified in a rectangular sill where twice the height gives twice the weight, but four times the strength. Assuming, for the sake of reaching some conclusion, that about 75 per cent. of the material in a car acts as beams, the final saving in weight would be represented by:

¼ of car at rate of say.....17 per cent.
¾ of car at rate of 100 $(\sqrt{1.17} - 1) = 9$ per cent. which for the three separate quarters gives .....27 per cent.
Total for four quarters.....44 per cent.
Or an average percentage for the whole car of .....$44 \div 4 = 11$ per cent.

This percentage of saving in weight is really much greater than the figure given, because the nature of steel renders it possible to make all joints and connections such that practically the theoretical values of the material can be obtained, while with a wooden car, the joints have to be especially heavy and bulky in order to secure a connection which will possess strength somewhat near to that of the member to be fastened. Furthermore, the integrity of a wooden structure cannot be maintained, owing to the shrinkage of wood causing loosening of bolts, and eventually general deterioration.

Once more calling your attention to the 11 per cent., I desire to state another reason why this figure is greatly increased. In its deduction, we reached the value as the result of comparing two cars of the same strength and capacity, but I do not think it needs much engineering knowledge to venture the assertion that the factor of safety in the average wooden car is not as great as it ought to be, or as it is in the carefully designed pressed-steel structure of to-day.

An imperative demand of the railroads, especially previous to the existing late boom in general business, was for a car of a capacity sufficiently great to earn a profitable revenue with the then existing low rates per ton on mine and agricultural products. This demand was due to the realization of the possibility of certain economies that could not be derived from any other carrier. Briefly stated they are:

Reduced number of cars required; reduced friction and atmospheric resistance; reduced empty-car movement; reduced switching service; reduced train length; reduced payment for car mileage and cost of inspection; reduced number of car parts; greater life; increase in traffic capacity of sidings, terminals, and, in fact, the entire road; decrease in cost of repairs from an average of between $35 and $40 per annum for wooden car, to an average established by complete reports, of $10 to $15, based upon costs in United States of America.

The weight of rails and strength of bridges being designed to carry the moving load of heavy locomotives and sleeping cars at a high rate of speed, are in excess of the requirements for ordinary freight car service. By using steel cars of great capacity, this available capacity of permanent way is utilized to a fuller extent.

I have previously mentioned that the percentage of freight-paying load is greater in a steel car than in a wooden one; and with this in mind, the following comparisons tell their own story:

Material.	Capacity.	Light Weight.	Ratio of load to total weight of car when loaded.
Wood	60,000	30,000	66.67 per cent.
Pressed steel	80,000	28,500	73.75 " "
Pressed steel	100,000	34,000	74.60 " "
Pressed steel	110,000	35,500	75.60 " "
Pressed steel ore car.	100,000	28,000	78.10 " "

The life of a pressed-steel car is a factor, the absolute value of which has as yet to be accurately determined. The great necessity, in a structure of this kind, is to give to the steel a proper protection in the form of a suitable paint-coating, and to carefully maintain it. This, in the United States of America, involves a nominal expense of about $8 every third year. M. Tomler, of the Eastern Railroad of France, tells us (1897) that steel in cars built in 1869, had in the twenty-eight years intervening, lost but 6 per cent. by corrosion. I believe a life of thirty years or over to be a very conservative estimate for steel construction, while experience of long standing has taught us that the average life of a wooden car is about fifteen years, and at the end of which time the car has practically been rebuilt.

One thousand pressed-steel gondola cars were recently figured on against specifications for wooden gondolas of 80,000 lbs. capacity. The wooden car weighed 18.2 tons, and was capable of being loaded with 82,000 lbs. of coal. The pressed-steel gondola weighed 16.1 tons, and was capable of being loaded with 86,200 lbs. of coal, with ordinary heaping in each case.

Below are some figures worked out on a basis of costs and earnings per ton per mile, the yearly mileage being assumed for the sake of example as 5,000 miles loaded, and 5,000 miles empty. For convenience, I have placed the cost per ton per mile of both live and dead weight at 3 mills, and the gross earnings per ton per mile of freight for the Eastern States of America at 6 mills.

Dead weight of wooden car as above..... 18.2 tons
Dead weight of steel car as above..... 16.1 tons
Difference in dead weight in favor of steel car.. 2.1 tons

Without considering the substitution of paying load for the eliminated 2.1 tons of dead weight, the saving shown by hauling 2.1 tons less of dead weight per car per year would be—
2.1 x 10,000 x .003..... $63.00
For thirty years (being the estimated life of the steel car) the saving would be—
30 x $63 .....$1,890.00

Wooden Car.

Yearly income from lading hauled 5,000 miles— 41 x .006 x 5,000.....		$1,230.00
Cost of hauling lading— .41 x .003 x 5,000.....	$615.00	
Cost of hauling dead weight— 18.2 x .003 x 10,000.....	546.00	1,161.00
Net earnings of wooden car per year.....		$69.00

Pressed Steel Car.

Yearly income from lading hauled 5,000 miles— 43.1 x .006 x 5,000.....		$1,293.00
Cost of hauling lading— 43.1 x .003 x 5,000.....	$646.50	
Cost of hauling dead weight— 16.1 x .003 x 10,000.....	483.00	1,129.50
Net earnings of steel car per year.....		$163.50
		69.00
Increased earning capacity per year of one pressed steel car over one wooden car.....		$94.50
Increased earning capacity of one steel car over a wooden car during its life of thirty years		2,835
Increased earning capacity of 1,000 steel cars over 1,000 wooden cars during their life of thirty years.....		$2,835,000

The total number of Schoen pressed-steel cars ordered to date is 26,412, possessing an average capacity per car of 47½ tons. The total carrying capacity of the above number of steel cars is 1,150,000 tons. The average weight of the steel cars as at present built is 16½ tons; and the total weight of all steel cars to date is hence 400,000 tons. If the above lading, viz., 1,150,000 tons, were to be carried in average wooden cars, we should find the total weight of these cars to be 640,000 tons. We have previously found the total weight of the steel cars to be 400,000 tons, and the cost of hauling the difference between these two totals, represents a part of the saving effected by the introduction of the steel car. This difference in weight amounts to 240,000 tons; and once more assuming a rate of 3 mills, with a total yearly mileage per car of 7,000, the resulting saving in dollars and cents amounts to $5,000,000 annually. This in effect, means that the pressed-steel cars now in use are saving at least 20 per cent. of their cost each year, in addition to saving in maintenance, and other profits and economy due to their use.

There is another aspect to the case which must not be overlooked when commenting upon the merits of the metal car, viz.: the vast increase in yearly mileage which this construction makes possible. On the Pennsylvania System, during the years '98 and '99, the average annual mileage of freight cars was in the neighborhood of 10,000 miles each, this figure referring to the accepted wooden construction. In the other hand it is very interesting to note that 300 Schoen pressed-steel cars running between some coal mines in the interior of Pennsylvania and Jersey City on the Atlantic border, averaged 120 miles per day, which means, when counting 325 running days in the year, a total mileage of 39,000, or about four times that of the wooden car. It goes without saying that such results mean large financial returns, and it is apparent that no wooden car could stand so severe a service, the time lost in repairs preventing even an approach to the above figures.

The history of evolution of the pressed-steel car is the history of its details. One of the first items undertaken as a specialty was the construction of pressed-steel bolsters for trucks, or for the body of wooden cars. Several types were manufactured. Hundreds of thousands of these bolsters are now in actual service on freight cars throughout the United States of America, and have uniformly given the greatest satisfaction. They are now the standards of the leading railroads of that country.

In the line of evolution the next step taken was the substitution of the present pressed-steel truck for the old-fashioned type, which ten years ago was in common and almost universal use. By degrees pressed-steel was

(Continued on page 640.)

*A few extracts from a paper prepared for the Paris meeting of the International Railroad Congress.

RAILROAD GAZETTE

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It is authoritatively announced that the rail makers have reduced the price of rails for large orders from $35 to $26 per gross ton, delivered on cars at either Western or Eastern mills. Based on the past year's record, it is probably safe to assume that this price will hold good during the coming year. There seems to be no doubt that this will result in placing large orders, for it is doubtless true that orders have been held for some time in expectation of lower prices. Although $26 is probably not as low a price as the railroad companies would wish to buy rails for, still at this price they can have the satisfaction of knowing that it is $5 a ton less than English railroad companies pay for their rails, and about $6 a ton less than Continental companies pay. It is doubtless a fact that the United States is now the cheapest rail market in the world.

French Four-Cylinder Compounds.

In this issue is given a summarized statement concerning recent locomotive practice in France. The abstract deals entirely with designs of four-cylinder compounds, a type which is not new in French practice, the first having been built in 1885 for the Northern Railroad, but which in recent years has so grown in favor that it is now standard on several of the more important French lines.

The distinguishing features of the type lie in the arrangement of the cylinders and in the fact that each cylinder constitutes a part of a complete engine. There are not only four cylinders, but also four cranks, four main rods, four cross-rods, and four complete sets of valve gears. The mere statement of this fact can hardly fail to produce an unfavorable impression on the mind of the American reader who looks upon any multiplication of parts in the design of a locomotive as an evil always to be avoided. A closer examination, however, will convince one that notwithstanding its obvious disadvantages, there are some rather fine things about the French design; that it presents an excellent solution of certain problems which all regard as important, but to which is often given but scant attention in working out a design. It is not our purpose to advocate the general adoption of the French design, but rather to call attention to some of the things which can be said in its favor.

The arrangement of the machinery is substantially the same whatever may be the other general characteristics of the locomotive. The two low-pressure cylinders are placed side by side between the frames and drive inside cranks set quartering on the forward driving axle. The details of these cylinders and surrounding parts are similar in every respect to those of all inside-connected engines. Thus placed, the low pressure cylinders are well protected from radiation and they connect with exhaust passages which are both short and direct. A pair of high-pressure cylinders is placed outside of the frame and these connect with outside cranks in the drivers of the second driving axle. These cylinders are not in the same cross-section with the low pressure cylinders, but are carried back on the frame a distance, which is substantially equal to the spacing of the driving axles, so that the main rod which connects an outside cylinder with the second driving axle, will be no longer than the main rod of an inside cylinder which connects with the first driving axle. The side frames between the high-pressure cylinders are strengthened by substantial cross-bracing in the form of a casting, which, so far as the frames are concerned, serves the purpose of a false saddle at this point.

The two or more pairs of driving wheels are connected by coupling rods, the several cranks being so arranged as to give a perfectly balanced engine. This is accomplished by having the pins for the coupling rods in the front drivers set diametrically opposite the inside cranks of the axle carried by these wheels, with the result that when one of the outside pistons moves forward, an inside piston moves backward, the reciprocating parts of each high-pressure cylinder being balanced by the reciprocating parts of its neighboring low-pressure cylinder, their cranks though attached to different axles, being in effect opposite. If each wheel is perfectly balanced for its revolving parts, and if the reciprocating parts of the high-pressure engine have the same weight with those of the low-pressure engine, the machine as a whole will be perfectly balanced both horizontally and vertically.

The obvious objection to the French design is the number of parts it involves. But locomotive designing even in this country is no longer the simple art which it used to be. As engines become more powerful, whether they are simple or compound, their structure becomes more complex and progress does not halt before an additional part. It used to be frequently asserted in this country that the success of the compound locomotive depended upon the development of the two-cylinder type; that it must have no more parts and must be as easily manipulated as the simple or it would fail to receive recognition. Such a view, however, is not being seriously urged to-day. The objection to a reasonable increase in the number of parts has not prevented the construction of many four-cylinder compounds, and cylinders have become so large that for many roads it is difficult, if not impossible, to design a two-cylinder compound which will deliver as much power as a modern simple engine. It would seem, therefore, that even in America, where designers are naturally disinclined to take the step, a more general adoption of the compound system must eventually lead to the use of four cylinders.

The number of parts composing the machinery of the French compound locomotive is practically double that of the simple locomotive, but it is not true that liability to derangement is doubled. The added parts are not untried either as to their form or in the purpose they serve, and for these reasons are less subject to break downs than some of the experimental forms of our heavy simple engines. Moreover, each pair of engines is required to deliver only one-half the power of a locomotive. The machine as a whole may be heavy and powerful, but the individual running parts are light. The piston and piston rods, crossheads and connecting rods, valves and gears driving them all have the same simplicity of form as in the simple engine, but transmit only half as much power. This means a great deal in the matter of maintenance. There can be no question that a 17 x 24-in. engine can be maintained to-day for much less expense than a modern engine of double its power. If it could be shown that two light engines can be kept on the road for a cost for repairs equal to that expended upon a simple modern engine of twice their power, the four-cylinder type would be at no disadvantage on this account. Again, while there are twice as many bearings to receive attention in the French engine as in the simple engine, all may be better proportioned to the service to be rendered, and for this reason may require less attention per bearing. For example, four connecting rods each transmitting 250 horsepower may lead to fewer occasions for delay than two heavier rods, each transmitting 500 horsepower. In case of the derangement, also, their light weight permits parts to be quickly handled.

The fact that both the high-pressure and the low-pressure engines are complete in themselves, allows the designer greater freedom in his choice of cylinder ratios and of the distribution of steam within the cylinders. He is free to work for maximum thermodynamic results. Since all driving wheels are coupled, the matter of equalizing the work is not important. In operation, also, the arrangement allows great flexibility. It is the practice of at least one French road to provide a reversing screw for each set of cylinders, which may be worked singly or together as may be desired, making the locomotive comparable, so far as its valve action is concerned, with the compound marine engine. If a high-pressure crank pin runs hot the engineman can, by a proper manipulation of his valve gear, and without materially affecting the efficiency of his engine, throw an excess of work in the low-pressure cylinder and by so doing reduce the work which must be transmitted by the hot crank pin.

An advantage of considerable importance which is presented in the design of the French engine is to be found in the relief which the cylinder arrangement gives to frames, axles and axle boxes. With all cylinders attached to the same cross-section of the engine and all driving upon one axle, the internal stresses which are concentrated upon that portion of the frame which intervenes between the cylinder and the main axle are very great. In the French engine these are distributed throughout a greater length of the frame, one-half being met by that portion which lies between the forward cylinders and the forward axle, and the other half by that portion which lies between the rear cylinders and second axles. In effect, the length of the working part of the machine is increased and the intensity of the stresses which fall upon any cross-section of the frame is correspondingly diminished. In a similar manner the axles are relieved. Instead of the full power of the engine being transmitted to one main axle, there are two main axles each receiving one-half of the whole power.

Again, in this age of heavy engines, and of trains which must be drawn at high speed without vibration, the perfect balancing of the French engine should not be lightly esteemed. With such locomotives there could probably be some increase in the weight on drivers and track could be more easily and more perfectly maintained.

It is of interest in this connection to note that considerable progress has of late been made in the development of four-cylinder balanced compounds, for the French locomotive is not alone in the field. The Strong balanced compound which was built in this country a number of years ago is similar to the French engine in having four cylinders and four cranks, two inside, and two outside of the frame. It differs from the French engine in the peculiarities of its boiler and in having an entirely novel valve gear; also, in the fact that its four cylinders are lined up across the engine and all drive the front driver or the axle. In the Strong engine, also, the high-pressure cylinders are between the frames and the low-pressure cylinders outside. Mr. F. W. Webb's four-cylinder compounds, a considerable number of which have recently been put in service on the London & North-Western, bear a close resemblance to the Strong engine. The cylinder arrangement and the method of driving are the same, excepting that in these, as in the case of the French engine, the low-pressure cylinders are between the frames. The inside cylinders of the Webb engine have the usual form of valve gear, the motion of which is transmitted by a horizontal rocker from the valve spindle of the inside cylinder to the spindle of the corresponding outside cylinder. The Bavarian State Railroad has in service a number of four-cylinder balanced compound locomotives with others building at Munich which are substantially of the French type. It is evident that all of these engines present certain characteristics which American designers believe to be good, and certain other characteristics, toward the adoption of which the current of events seems to be leading us. The weak points in the French design are apparent.

Annual Reports.

Atchison, Topeka & Santa Fe.—The report of this company for the year to June 30 is quite remarkable. The miles of line composing the Atchison System amounted to 7,425.65, being an increase for the year of 317.19, and the average miles operated were 7,341.34. On this mileage the company earned gross $46,232,078, the increase being $5,718,580, or 14 per cent. The operating expenses decreased $85,182, and amounted to $27,521,499. The net earnings from operation were therefore $18,710,579 and the percentage of working expenses to earnings was 59.53 as compared with 68.14 the year before. The decrease in working expenses was in maintenance of road and structures, $1,317,736, or 17 per cent. from the preceding year. Maintenance of equipment increased $457,000, transportation expenses increased $700,000 and general expenses $75,000, still leaving a net decrease. The decrease in maintenance of road and structures is accounted for by the large expenditures in the three years immediately preceding. In the year now reported on, the expenditure under this head per mile of road was $865.56. In the three years before that it had averaged $1,065 per mile.

But obviously the increase in gross earnings, which flowed from a great increase in the volume of traffic, must have been accompanied by a much smaller increase in transportation expenses in order that the total working expenses should have been diminished. In fact, the ton-miles increased 561½ millions, or 19.41 per cent.,

and the passenger miles increased more than 56 millions. or 15.74 per cent., while the item of Transportation and Traffic in operating expenses increased only $700,364. While the ton-miles increased 19.41 per cent. the freight train-miles decreased 12.87 per cent. and the average freight trainload increased from 161.54 tons to 221.4, or 37.06 per cent. The average freight train-mile revenue rose from $1.65 to $2.16, or 31.26 per cent. This result has been brought about in part by heavier power and in part by better loading of the engines, and in turn all of this has been made possible by strengthening the roadway and by reduction of grade. Further reductions of grade will be made and surveys for this purpose are now going on.

The change in gross earnings is well shown in a table giving earnings per mile for four years. In 1897 the average gross earned per mile was $4,438, and in 1890 it had risen to $6.297; in other words, it had increased 41.89 per cent. In the same period the freight earnings rose from 22 millions to nearly 33¾ million dollars, and the passenger earnings rose from 5½ millions to 9⅛ millions. Meantime, the average miles operated had increased from 6,899 to 7,341.

As illustrating the magnitude of the work done in the past four years it is said that 2,493 bridges, aggregating 38.79 miles in length, have been replaced by steel bridges, embankments, arch culverts and iron pipe culverts. Last year half a million dollars was spent on bridge and culvert masonry and charged to capital expenditures and $865,000 was spent on reduction of grades, change of line and other improvement of the road. In the year $1,113,000 was charged to capital account for new equipment in addition to equipment acquired by use of the Replacement Fund.

At the end of the year the locomotives in service numbered 1,136 and cars of all classes were 29,395. During the year $191,382 was spent on air-brakes and automatic couplers, of which sum $123,553 was charged to working expenses. At the time of writing the freight cars equipped with air-brakes number 28,024 and with automatic couplers 27,710 out of a total of 28,042. Out of the rolling stock Replacement Fund the sum of $947,483 was spent during the year for locomotives and cars. A total of 109 locomotives was bought and 20 locomotives were under contract for delivery in the four months following the close of the report.

Brief mention is made of the San Francisco & San Joaquin Valley Railway. The entire line was opened for freight traffic on May 1 and for passenger traffic July 1, 1900, but none of the operations are included in the statistics of the year reported on. It is said, however, that the freight earnings were showing a very gratifying increase. On the whole it is pleasant to have further evidence that the Atchison is in the full tide of prosperity.

Northern Pacific.—In the fiscal year ending June 30th this company increased its gross earnings $3,973,643, or 15 per cent., and its net receipts $1,827,000, or about 13 per cent., and had a balance of revenue available for dividends of $9,483,000. This is not materially different from the report of the Atchison. That company's balance over interest was $9,735,000, but its gross earnings were $16,000,000 above those of the Northern Pacific. The ability of the Northern Pacific to show practically the same net income as the Atchison, starting with so much less gross receipts, is in part due to its lower fixed charges and in part to its ability to handle its traffic at a less cost. The question of rates enters, but not to a material extent. Both companies for the first time report ton-mile revenue below 1 cent, that of the Atchison being 9.76 mills, against 10.19 mills a year ago, the Northern Pacific reporting a ton-mile rate of 9.87 mills against 10.47 mills last year.

Questions of grade and conditions affecting traffic movement are to be considered (the profile of the Northern Pacific is far better than that of the Atchison) and perhaps also the condition of equipment, for the Northern Pacific was able to obtain an average revenue trainload of 328 tons, being 50½ tons or 18.2 per cent. more than in 1899, while the average train-load of the Atchison was 240 tons last year, against 172 tons in 1899; the smaller train-load reported by the Atchison is attributable in part to the fact that it has only recently added heavy motive power in large quantities.

The sum of the matter is that the Northern Pacific last year operated its road for 47.4 per cent. of its gross receipts, while it required 59½ per cent. of the gross receipts of the Atchison. But while the Northern Pacific decreased its ratio only slightly, the Atchison's percentage was 8⅔ less than in the previous year. The division of the operating expenses of the two properties is interesting, and is shown below, both in the aggregate and per mile of operated lines.

	Atchison.	Per mile.	Northern Pacific.	Per mile.
Maintenance way..	$6,354,372	$866	$4,874,087	$1,034
Maintenance equip.	5,267,832	718	2,232,400	473
Transportation	14,736,147	2,007	6,514,490	1,381
General	1,163,148	158	773,652	164
Total	$27,521,499	$3,749	$14,394,629	$3,052
Average miles oper.	7,341		4,714	

Northern Pacific's expenses, as given above, however, do not allow for nearly $3,000,000 appropriated from the earnings of the past year and expended for improvements. While the company carried on, as in the immediately preceding years, a heavy amount of betterment work, it charged to capital account only the cost of additional equipment, branch lines and real estate purchases. Improvement expenditures on the roadway charged against earnings during the year amounted to $1,686,114. The largest single item was $229,500 for bridging; other large items being $300,666 for widening embankments, ballast, etc.; $193,000 for changes of grade and line, and $157,400 for constructing new spurs and passing tracks. There was also charged against earnings $641,582 for equipment expenditures, of which $493,200 was for additional equipment.

This sum, however, included only the smallest part of the cost of new equipment added during the year. Besides the amount mentioned above $795,000 was spent during the year and charged against capital and $318,400 was included in operating expenses for new equipment built or purchased to replace older rolling stock. Altogether, 32 locomotives, 30 passenger cars and about 1,200 new freight cars were added during the year. Allowing for equipment sold or destroyed, the net increase in engines employed in road service was 31 or 6⅓ per cent. The weight of the engines increased in about twice this ratio, the hauling capacity of the engines in service on June 30 last being 12.2 per cent. greater than a year ago.

The addition of the heavy locomotives has made possible the transfer of some power to other divisions so that the tonnage rating of engines on some divisions has been materially increased, though the table showing the rating of engines does not naturally record the extraordinary changes noted a year ago. The highest engine rating is now, however, 1,600 tons, against 1,400 a year ago, and even larger increases have been made on other divisions, where the total rating does not reach these figures.

Last year's business was much the heaviest in the company's history and, the report says, taxed the power and equipment to the utmost. The tons of freight carried increased 22.4 per cent., and the tons moved one mile. 20½ per cent., the average haul decreasing slightly. Total freight earnings increased $2,654,200, or 13⅔ per cent. Only 124,875 additional freight train miles, being but 1.9 per cent. increase, were run to haul the increased tonnage. Freight train mile earnings, therefore, were above the best previous figure, at $3,295, against $2,955 per freight train mile in 1899, a gain of 11½ per cent., despite the loss of 5¾ per cent. in the average ton-mile revenue. In 1896, before the reorganization, earnings per freight train mile were $2,222 on a ton-mile rate of 1.113 cents, while in 1890, when the ton-mile receipts were 1.40 cents, train mile earnings were only $1.843. Then the revenue train load was but 130 tons, whereas now it is reported as 328 tons. Vice-President Kendrick summarizes the progress in transportation results in the last ten years as follows: Increase in ton-miles, 101¼ per cent.; decrease in train miles, 20.1 per cent.; increase tons per train mile, 152 per cent.; increase tons per loaded car mile, 49 per cent.; decrease in revenue per ton mile, 29½ per cent.; increase in revenue per train mile, 79 per cent.

Little space is available to refer to the important financial changes. During the year, the last of the old general first mortgage bonds were retired through proceeds of land sales. The St. Paul & Duluth has been purchased, and various new lines have been built, capital charges for such work being $1,584,901, besides $724,146 for real estate. Including equipment and other miscellaneous items, the aggregate capital charges reach $3,374,047 for the year. This amount, however, and cost of capital work in other years, has been advanced from the treasury. There is in fact due the company from trustees $5,837,000 improvement bonds, which have been earned. The company has cash assets in excess of $9,250,000, and betterment and enlargement funds of nearly $9,000,000.

Boston & Maine.—With an increase of $2,276,148 in gross receipts in its last fiscal year, this company reports a surplus balance over all payments of only $172,016, and the company exemplifies the policy notable in the statements of the other New England roads, of appropriating practically all the increases of income for improvements or other extraordinary work. Thus, the New York, New Haven & Hartford, in the year to June 30 last, increased its gross revenue $3,181,000, but its surplus after dividends was only $391,335, against $207,300 in 1899. The Boston & Albany gained $631,000 in gross receipts in the year, but its undivided surplus was $23,686 against a net surplus of $31,393 a year before. During the year the Boston & Maine raised the dividend rate on its common shares from a 6 per cent. basis to 7 per cent., but this increase accounted for only $281,000. The larger part of the gain in gross receipts was absorbed in betterment work. The aggregate expenditure on such work during the year was $1,027,497, of which over half was for equipment. In addition to improvements carried on by charging their cost against earnings, the company expended $884,948 or capital account in 1900. In addition, $2,765,754 was expended in the purchase of the Portland & Rochester and other lines. Capital charges included $350,000 for 11 miles of second track, involving the separation of ten highway grade crossings.

Besides the increased expenditures for new equipment, improvements, etc., charged directly against expenses, there was an increase in working charges last year of $1,856,374, or 13 per cent. Of this amount $150,000 was due to new mileage operated; $400,000, or over 25 per cent., was due to increased cost of fuel, and the larger quantity required by increased train mileage. About $200,000 was due to adjustments of wages and $600,000 was because of the larger train mileage and station service necessary in handling the greater volume of business.

Our Railroads in 1899.

Advance sheets of the introduction to Poor's Manual for 1900 are just received, being more than a month later than usual. From the statistics gathered there we are informed that the railroads of the United States completed to Dec. 31, 1899, aggregated 190,833.41 miles. The net increase in the calendar year 1899 was 3,981.36 miles.

The railroads making complete reports to the editor of Poor's Manual covered a mileage of 186,279.77 in addition to which 310.61 miles reported earnings only. The traffic statistics, therefore, are based on the lesser mileage reported. In the year the movement of passengers amounted to 14,860 million passenger-miles. The freight movement amounted to 126,992 million ton-miles.

A compilation is made of the freight and passenger traffic for a series of 13 years. We find there that the average receipts per passenger per mile amounted to 2.002 cents, being an increase of .008 cent over 1898. With the exception of 1898 it is the lowest rate recorded, but the receipts per passenger train-mile were the greatest recorded since 1894, amounting in 1899 to 83.79 cents. The passenger receipts per mile of railroad amounted to $1,597, which was greater than in any year since 1893. Probably the average distance traveled per passenger is gaining with the growth of the trolley roads, which are taking away more or less short distance travel. This perhaps accounts for the higher passenger rate as compared with the year before. At any rate, the average distance traveled per passenger in 1899 was 27.63 miles, being the longest average recorded so far as the tables carry us back, namely, 13 years. In 1898 the average journey was 26.55 miles and for the years preceding it has varied from 23.59 as the shortest journey to 25.09 as the longest, this longest journey having been in the year 1893, when we suppose the World's Fair at Chicago entered to pull up the average journey.

The compilation of freight traffic statistics for 13 years shows, of course, the lowest freight rate ever received, namely, 0.726 cent per ton per mile, as compared with 0.758 in 1898 and 0.797 in 1897. The rate goes rising steadily back until 1887 when it was 1.034 cents. Further back than that these tables do not carry us, and we do not stop now to consult other figures. Although the freight rate is lower than in any one of the 13 years here presented the receipts per mile of railroad and per freight train-mile are higher than in any other one year, indicating greater density of traffic, and also heavier train-loads; that is, the average receipts per freight train-mile in 1899 amounted to 172.61 cents. As we follow the table back this figure declines until 1894, when it begins to run up again, and in 1887 it is 161.51 cents. In 1898 it was 160.09. The freight receipts per mile of railroad in 1899 amounted to $4,952. The density of traffic is indicated by the tons per mile of railroad, which in 1899 amounted to 5,238, being 279 tons more than in 1898 and 1,208 tons more than in 1887. The growth in train-load is indicated in another column of the table of which we are speaking. This column shows the average freight trainload in 1899 to have been 237.64 tons; the year before it was 211.06, and as we follow the years back it steadily declines, having been in 1887 156.16 tons.

A considerable part of the introduction to the Manual this year is occupied by a review of the statistics of the development, finances, etc., of the railroads of the United States, referring especially to the last 20 years. This chapter in our railroad history, which Mr. Meany has been preparing with great diligence, we have mentioned before. He reviews at considerable length the history of railroad construction, giving statistics collected in such a form as will be very convenient to those who have occasion to refer to such matters, and a good many of us know how extremely difficult it has been to get specific information as to the work done in any one locality or any one period in the years past. Other paragraphs of his review consider the matters of consolidation, of the formation of railroad systems, of capitalization and the return thereon, of receiverships and foreclosures and of the relation of fixed charges to capitalization. The student of railroad matters will be grateful to Mr. Meany for his labors in this field.

That ticket scalping is still a profitable business is shown by the ingenuity and persistency of the brokers, and by the large sums of money expended by them in attempting to beat the railroads. At any rate, this appears to be true in Chicago, if not everywhere. It will be remembered that about a year ago the Central Passenger Association adopted an elaborate engraved steel embossing stamp to be used by the agent in Chicago who validated the return portions of round-trip excursion tickets. For a time this device worked well; to make a copy of the stamp was a slow and expensive job, and, moreover, the design was copyrighted. But after a time the brokers recovered their courage and they succeeded in making counterfeits of every form of engraved stamp that the railroads could devise; and they could make a die in three days. The next move of the roads was to try the efficacy of the water marked paper which is now prescribed by the American Association of General Passenger and Ticket Agents for use in all joint tickets. On the occasion of the Encampment of the Grand Army of the Republic, which has just been held in Chicago, certificates, printed on this paper, were attached to the return portion of each excursion ticket. On presentation of a ticket at the office by an arriving passenger he was given a receipt for the ticket, which receipt was one of the

three coupons of the certificate to be issued and signed by the joint agent. One of the other coupons is pasted to the return portion (held by the agent during the stay of the passenger in Chicago) and conductors accept tickets only when accompanied by this certificate. The third coupon is the agent's stub. The passenger is identified by his signature, when calling for the ticket, the same as before. As everyone knows, however, signatures to tickets are easily counterfeited, and the feature of the new certificate which is depended upon to prevent fraud is the water mark. It was to be expected, however, that the scalpers would attempt to get around this expedient, as they have with every previous one, and this expectation was not disappointed. The new certificate had not been long in use before it was discovered that expired and worthless tickets were being presented. To these were attached counterfeit pasters resembling the genuine quite closely, except that the form of the water mark was produced by printing on the surface of the paper. The deception is easily detected by holding the ticket to the light, but the swindlers probably expected that conductors, in the hurry of collecting tickets, would not take the trouble to make this test. All conductors were promptly warned, however, and unless the rascals who do this counterfeiting can make an arrangement with a paper mill to furnish them with suitably water marked paper it would seem that it ought to be possible to check this last trick. If a paper mill should be called into the scheme, probably it would then be necessary to have a variety of colors and of water marks so as to use different designs and combinations on different days. It appears that to avoid detection by gatemen at stations, who sometimes have more time and better light than conductors do, the Chicago scalpers sometimes furnish passengers with short-distance genuine tickets with which to get admission to the train.

An Epoch in Railroad Transportation.

(*Continued from page 637.*)

introduced into certain parts of its details, until finally the pressed-steel pedestal truck became an accomplished fact. For first-class roadbeds this type will give very good satisfaction, but experience has demonstrated that with bad or uneven tracks it is necessary to have the frame flexible in a horizontal plane. This last condition led to the pressed-steel diamond truck. The cross transoms are made very light, while withal possessing rigid connections to the truck frames at each side. To help the general elasticity of the structure, the transoms have part of their webs cut away, decrease in strength due to this blanking being hardly perceptible.

Following the truck frame, the next and most important item in the construction of a car is the underframing. It is the foundation upon which the superstructure is built, and it must be strong enough not only to sustain the load, but also to withstand shocks due to the application of air-brakes, and severe end concussions. The lightness of the ordinary underframing of the wooden cars, whether intentional or not, throws strains upon the sides, of a character which the shrinkage of wooden construction makes disastrous. Such a car when loaded will cause a yielding of the floor system, producing, in turn, bulging of sides and ends. To produce a stiff construction means a sub-structure, strong and rigid enough to fully take care of its work, and such requirements are met by the introduction of the pressed-steel underframing when designed with its proper factor of safety. The mechanical and engineering departments of railroads have for several years been considering the advisability of using steel underframing for cars, and it is now generally conceded that its introduction will mean greater economy in repairs.

The last twenty-five years have been very rich in the development of mechanical ideas of a more or less startling character and wide-reaching effect, but I do not believe, however, there has been any one of greater importance than the advent of the large-capacity, lightweight, pressed-steel car, completely revolutionizing, as it has begun to do and will eventually complete, the entire carrying trade of the world. The utility of an innovation has always to be gauged by its results, and remembering that the pressed-steel car is hardly more than two years old, the proof of its title to merit is clearly emphasized when calling to your attention the fact that since the first car was placed on its trucks, 26,000 more have found their way as carriers on the different railway systems of the world. I have already commented upon the saving effected by its introduction as meaning to the railroad companies in many instances and under certain conditions, the difference between a dividend and a deficit, and our leading trunk lines have been quick to realize this as a fact.

The Galveston Disaster.

Rail communication with Galveston was opened up September 20th, when the first passenger train of the Galf, Colorado & Santa Fe crossed the temporary bridge across the bay. The Wharf Company completed temporary repairs to the wharves sufficient to permit of the handling of business Sept. 22, since which time traffic, both passenger and freight, has been handled with substantial regularity. The construction of the temporary bridge was under the direction of Third Vice-President J. M. Barr, of the Atchison, Topeka & Santa Fe, and the other Galveston terminal lines cooperated. The roads terminating at Galveston have not yet been able to reach any actual estimates of damage sustained.

The Gulf, Colorado & Santa Fe (Atchison) lost about four miles of track north of Virginia Point; and stringers, the track, the draw and about 75 ft. of piling from the bridge across the bay.

The Galveston, Houston & Northern, and the Galveston, Houston & Henderson lost about the same amount of track and sustained substantially the same damage to their bridges.

The Southern Pacific has probably been the heaviest sufferer in Galveston, by reason of the damage to its wharf property, now under construction. The other roads use the wharf facilities of the Galveston Wharf & Terminal Co. General Manager Baily, of the Wharf Company, estimates that company's damage at $300,000.

The Gulf, Colorado & Santa Fe, in addition to their loss of its bridge, suffered damage to tracks between the bridge and 42nd street, and also lost a train shed and a roundhouse.

The Union Passenger Depot (owned by the Santa Fe) is a new and substantial structure and was not materially damaged.

All the roads suffered damage to station buildings on the main land back for a distance of about six miles. The Missouri, Kansas & Texas had one locomotive and about 25 cars damaged. The Gulf, Colorado & Santa Fe and Galveston, Houston & Henderson also suffered considerable damage to their equipment on the island.

Approximate figures as given out by the various lines at the present writing are as follows:

Southern Pacific	$250,000
Atchison	125,000
Galveston, Houston & Henderson	125,000

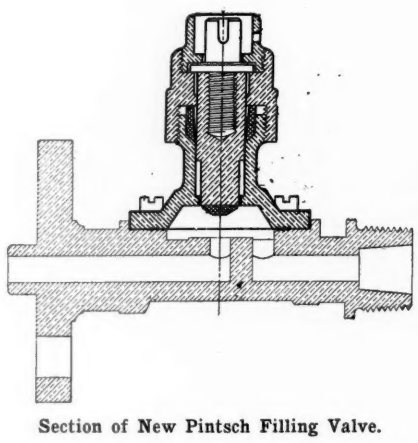
These amounts are said to be maximum.

The greatest damage sustained by the grain elevators consisted in unroofing, and most of them were blown off down to the grain line. They contained 2,300,000 bushels of wheat, on which experts estimate that the damage will not exceed 2 per cent. Most of the wharf sheds are wrecked, but the wharves proper suffered comparatively little injury. Elevators and wharves have now been practically repaired. The County (highway) bridge across the bay was entirely swept away.

An understanding has been reached between the interested companies to at once prepare for the erection of a joint bridge across the bay. The bridge will be about 2⅛ miles long, and will be built of steel, for two tracks, and will be about 10 ft. higher than the present pile structures. It will have a draw span of sufficient width to pass all vessels crossing the bay.

Improved Pintsch Gas Filling Valve.

To more fully control the escape of gas while charging car reservoirs, the Safety Car Heating & Lighting Company has made a new filling valve, which is here illustrated. While the advantage gained has been shown to be very marked, the change, from the valve now commonly used, to the new and improved valve, involves but slight change of parts. In applying the improvement to present equipment, the only change that is necessary is the use of a new valve bonnet, and bonnet-cap of the cover. The new valve bonnet fits the regular valve body known as "No. 65." The changes may be readily seen in the illustration, in connection with the following description:



Section of New Pintsch Filling Valve.

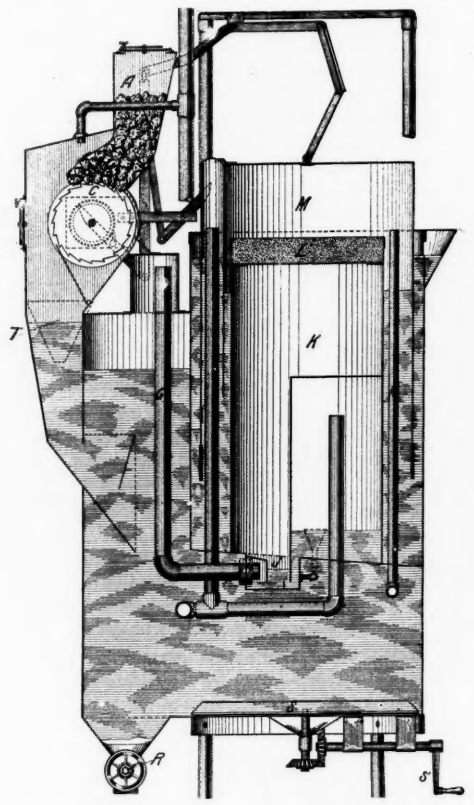
The valve carrier, shown as the central moving part of the device, has a square extension, at the lower end of which is a disk. The extension passes through a square opening in the valve bonnet, thus preventing the valve carrier from turning. The valve stem is held between the valve stem nut and the packing nut. The packing, which operates upon the regularly recognized principle of metallic packing, is adjusted by use of the packing nut. To remove and renew the valve carrier it is only necessary to first remove the packing nut. The pitch of the thread on the packing nut and the bonnet is the same as that of the thread on the valve stem and the valve carrier. In tightening the packing nut on the bonnet there is, therefore, no possibility of distorting or unknowingly interfering with the movement of the valve. The substitution of the new filling valve for the old valve now in use is very desirable, and therefore in furnishing repairs for filling valves parts of the improved filling valve will be furnished, as far as possible, by the heating and lighting company.

Acetylene for Railroad Lighting.

Those railroad officers who have to consider the method of lighting railroad yards and buildings will perhaps remember the admirable paper by Mr. Lipschultz, of the Great Northern Railway, which was published in the *Railroad Gazette* of July 27, treating of the subject of acetylene lighting theoretically, also telling of the actual experience of the Great Northern Railway. In that paper he gave the following classification of the methods of generating gas from calcium carbide.

(1) Water drips or flows to the carbide. (2) Water rises to the carbide from below. (3) Carbide is dropped or thrown into a large body of water.

The first system is used mostly for small experimental and portable apparatus. This method of generating is



The Bournonville Generator for Acetylene Gas.

attended with high temperatures giving impure gas, and sometimes dangerous pressures are produced. Generators of the second system have practically the same objections as those of the first-class and continue to generate gas when the water is removed from carbide. Mr. Lipschultz's decision was that the future belongs solely to the generators of the third system. This classification seems to be the one now accepted by those who have made a special study of the matter.

A generator of this third class, made by the General Acetylene Company of New York,* is shown herewith, and it is known as the Bournonville generator. The dry carbide is placed in the hopper A, from which it is fed down through chute T into the generator filled with water. Deflectors are arranged to prevent gas escaping by the chute, and carbide is not taken from the hopper except as gas is used.

This latter result is brought about by a contrivance such that the feed drum C is caused to revolve as the floating gasometer M falls. Thus as the gas is used the carbide is fed automatically to the generator in very small quantities. We need not to stop to describe the connection from the gasometer to the feed drum, but it is easy to see how the former can be made to actuate the latter.

The gas formed in the water is carried through the pipe G and condenser K to a dry filter L, which removes sulphurous and phosphorus impurities; and passing through that filter it is collected in the gasometer M. This latter is weighted to provide uniform pressure. From the gasometer the gas is taken off by the service pipe N. A water trap J prevents back flow of gas. A residue of slaked lime is collected in the bottom of the tank and discharged through the outlet valve R. An agitator is provided in the bottom of the generator turned by the hand crank S¹ and fresh water is supplied occasionally through a funnel.

This apparatus is made in sizes varying from 10 lights up to 500 or more, each based on once charging for a run of 10 hours. Several hundred of these generators have been put in service, generally for lighting houses, and it has been used somewhat for railroad buildings. It appears to be applicable to lighting stations, roundhouses, yards and indeed any of the stationary plant of a railroad, particularly where it is not thought desirable to put in a costly electric apparatus.

The company developing this generator has not yet attempted to enter the field of train lighting. It will be remembered probably that the investigations of Mr. Lipschultz led him to believe that if acetylene gas is used for this purpose it will be by generating the gas in a fixed plant and storing it in tanks on the train.

*56 University Place.

The Hilo Railroad of Hawaii.

The Hilo Railroad Company, a corporation organized to build railroads on the Island of Hawaii, has completed and in operation eight miles of line from Hilo to Olaa Plantation, and nearly finished grading 16½ miles more line to Puna Mill, on which track will be laid and trains in operation early in November. A branch line will also be built from the present terminus, Olaa Mill, to the volcano house, taking in the rich and extensive lands of the Olaa District, and also enabling passengers to be landed at the active crater of Kilana within two hours after leaving Hilo. The company also have built shops at Hilo, where they build cars and equipment, consisting of machine shop, 45 x 130 ft.; woodworking shops, 45 x 130 ft.; erecting shop, 45 x 130 ft.; foundry and blacksmith shop, 45 x 80 ft.; paint shop, 45 x 90 ft.; coach house, oil house, storehouse and a 5-stall roundhouse, with all necessary yard room, wharfs, etc. The track was completed to Olaa Mill on June 2, and the first load of freight hauled the next day and the road opened for general freight and passenger traffic on June 14, since which time two regular trains each way have been run. This road reaches the Olaa Sugar Company's plantation which, in two years, will be turning out 50,000 tons of sugar annually, and the Puna Sugar Co.'s plantation, which will in the same time turn out 25,000 tons annually, besides touching lands in Olaa of 10,000 acres, capable of producing 50,000 tons more of sugar. The road is standard gage, the only standard gage on the Islands, with modern equipment, all cars being 80,000 lbs. capacity, with air-brakes. The motive power was furnished by the Baldwin Locomotive Works, consisting of 70-ton locomotives, the largest ever imported to the Islands. Mr. B. F. Dillingham, of Honolulu, is the President, and Mr. W. H. Lambert the Superintendent. The address of the company is Hilo, Hawaii.

TECHNICAL.

Manufacturing and Business.

The Standard Pneumatic Tool Co. has opened offices in Boston, Mass., at 185 Summer street. F. A. Barbey has been appointed representative for the New England States.

The American Bridge Company announce that Mr. August Ziesing has been appointed as the General Western representative of the company, with headquarters at Chicago, Ill.

The Ashton Valve Co. received at the Paris Exhibition three medals for its exhibit of pop safety valves and gages. One of these was a silver medal, being the highest award possible to obtain in the class of exhibits. The other two are bronze medals.

Mr. C. A. DeHaven, who, at different times, has been Superintendent of Motive Power of the Omaha & St. Louis and Omaha, Kansas City & Eastern, and Master Mechanic of the Kansas Midland and Kansas City, Pittsburgh & Gulf, has accepted a position with the Peru Steel Casting Co., Peru, Ind., in charge of the sales department.

The Russell Snow Plow Co., Tremont Building, Boston, Mass., has received orders to build, this fall, Russell snow plows and flangers of various styles for the following roads: Boston & Albany, Central of New Jersey, Chicago, Milwaukee & St. Paul, Delaware, Lackawanna & Western, New York Central & Hudson River, New York, Chicago & St. Louis and New York, Ontario & Western.

The E. D. Albro Co., of Cincinnati, Ohio, has recently issued a circular relative to reorganization of the official staff of the company. Robert Laidlaw, for many years President of the Laidlaw-Dunn-Gordon Co., now a part of the International Pump Co., and an officer in the National Association of Manufacturers, is President; T. G. Williams, an expert accountant, and lately General Manager of the Marmet Co., of Cincinnati, is General Manager and Treasurer; Thomas McDougall is Secretary and Purchasing Agent; George W. Vanderbilt, for more than 24 years Superintendent of the plant, has been re-elected to that position, and his son, W. H. Vanderbilt, remains as Assistant Superintendent. The gentlemen named, with Taylor McDougall and Hon. Richard P. Ernst, constitute the Board of Directors.

Iron and Steel.

Mr. Chas. Prust, until lately Superintendent of the Norway Iron & Steel Works, died recently in York, Pa.

The American Steel & Wire Co., on Sept. 17, resumed operations at its Southside wire and nail mill with 400 men.

The Reading Iron Works' sheet mill, at Reading, Pa., started up, on Sept. 20, after two months' idleness. The company will build an addition to its pipe mill, 75 x 108 ft.

A large number of inquiries from Mexico, Australia and Japan were reported made during the week in the Eastern market, for rails in fractional lots for quick shipments.

E. H. Aldrich has resigned as Second Vice-President of the Sloss-Sheffield Steel & Iron Co. at Birmingham, Ala., to which position he was appointed several months ago when former President Sol. Haas resigned. Mr. Aldrich was in charge of the company's coal properties as General Manager.

Mr. Henry H. Quimby has resigned as Chief Engineer of the Phoenix Iron Works, Phoenixville, Pa., and has established the Quimby Engineering Co., with office at 915 Ridge avenue, Philadelphia. The new company will engage in consulting (civil and mechanical) engineering, and will make the Shaw's mercury pressure and vacuum gages, succeeding Thomas Shaw.

Mechanical Draft.

In a recent paper on Mechanical Draft, read before the New England Cotton Manufacturers' Association, Mr. Walter B. Snow states that from a comparison of a considerable number of plants it appears that under ordinary conditions "A single-forced draft fan with direct-connected engine and short stack can be installed for less than 20 per cent. of the cost of a brick chimney; a single induced-draft fan with direct-connected engine and short stack will cost less than 30 per cent. of a chimney; and a duplex induced-draft apparatus consisting of two fans with direct-connected engines, inlet and outlet connections and short stack will cost but little more than 40 per cent. of a chimney. The latter arrangement is only employed where, as in the case of an electric lighting plant, it is the practice to introduce relay units."

Water Tube Boilers.

Surprise is naturally felt by those who are not fully conversant with the whole of the circumstances that difficulties connected with the management of water-tube boilers and high-pressure machinery should take so long to overcome, and they are apt to assume that because they are not all removed in the three or four years that have elapsed since water-tube boilers were introduced into the British Navy, they must be insuperable. A little consideration will show that up to the present, and for some time to come, the engine-room staff of every newly commissioned water-tube boiler ship must be largely composed of those who have had no previous experience with this type of machinery, as the number of water-tube boiler ships in commission has up to the present borne so small a proportion to the total number of ships for which crews are provided. The rate at which crews can be trained will increase rapidly as more water-tube boiler ships become available, and as special arrangements for training engineers, engine-room artificers and stokers augment the number of men with experience of these boilers. —*Cassier's Magazine.*

Street Car Brakes in Germany.

The Society of German Tramway Administrators, which was formed a few years ago, held its sixth general meeting early this month. Among the subjects discussed were accidents on tramways and braking on electric tramways. As compared with the year preceding there was in 1899 a reduction in the number of accidents arising from excessive speed on curves, in accidents to children and to persons entering and leaving cars. On the other hand, accidents due to collisions had become more frequent. Concerning brakes nothing definite could be submitted at this meeting, but in the course of the discussion it was said that the Administration of Frankfort is requiring the use of continuous brakes where trailers are used, and the sum of opinion seemed to be that the introduction of continuous brakes will soon become necessary. The matter has been placed before the Minister of Public Works with a view to the recognition as a principle of the use of continuous brakes on German electric tramways.

Prussian Locomotives.

The Prussian State Railroads lately called for bids for constructing 480 locomotives, and their design gives some idea of what is considered most available at present for these lines: 61 are to be 8-wheeled compound express engines with trucks; 47 8-wheeled compound passenger locomotives with trucks; 14 6-wheeled compound passenger engines; 31 8-wheeled freight engines with front "Adam" axle; 30 8-wheeled freight engines; 65 8-wheeled compound freight engines; 32 8-wheeled passenger tank engines with "Adam" axle at both ends; 72 8-wheeled freight tank locomotives with rear "Adam" axles; 60 6-wheeled tank locomotives for branch railroads, and 10 8-wheeled tank locomotives with Krauss truck. According to this of 154 passenger engines 122 are to be compound, and of 198 freight engines 65 compound. The other 70 non-compound engines are probably for both services or switching.

The Simplon Tunnel.

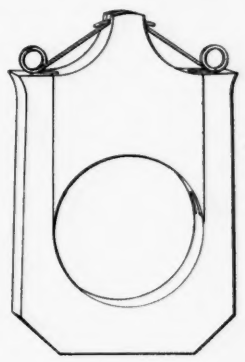
The penetration in the Simplon Tunnel at the end of June had reached 18,456 ft., and the entirely completed portion was 10,500 ft. long. The temperature of the rock at a distance of 7,194 ft. from the southern portal was 92° F., while 10,464 ft. from the northern portal it was 80°. As the heat is in proportion to the thickness of the superincumbent rock, it is calculated that at the center of the tunnel it will be 109°, which would be insufferable to the workmen but for abundant ventilation with cooler air. The rapidity of the work was increased after June, and at the end of August the aggregate penetration was 20,231 ft.

Changes in the Carnegie Company.

At a meeting of the Board of Directors of the Carnegie Steel Co. the following changes in officers were made: The resignation of Andrew M. Moreland as Secretary and Director was accepted and W. W. Blackburn was appointed to succeed him in both positions. Geo. Megrew, Purchasing Agent, also resigned. W. C. McCausland, Cashier for the Carnegie, Phipps Co., and the Carnegie Steel Co., Ltd., succeeds Mr. Blackburn as Assistant Treasurer of the Carnegie Steel Co. C. E. Locke succeeded Geo. H. Wightman as Sales Agent at Boston.

The American Dust Guard.

The accompanying cut shows the American dust guard, a simple and effective device for its purpose. The action is plain from the illustration, being simply that of the sliding upper portion of wood controlled by the extended ends of two steel coil springs, which are fastened upon the body of the dust guard proper. With care used in the selection of wood and the laying out of the work in manufacture, the wear is made to come upon the grain ends of the wood, thus insuring much greater durability than where the wood is worked up without regard to grain. The range of wear is 1½ in. before renewal of the top part is necessary. In renewal the operation is extremely simple, the springs being drawn back and a new upper portion inserted in place of the old top block. The extreme simplicity of this device is one of the strongest features in its favor. It has long since passed the experimental stage, and it is said that there are now more than 400,000 in use on various railroads.



Oil Fuel On the Atchison.

In the annual report of the Atchison, Topeka & Santa Fe we are told that the use of fuel oil on the Southern California line continues to give satisfactory results. The company has acquired oil lands near Fullerton and has several wells in successful operation. Other oil fields have been developed in the vicinity of Bakersfield and Fresno and all the engines on the San Francisco & San Joaquin Valley are being converted into oil burners. The Santa Fe Pacific engines running between Mojave and Needles are being changed to oil burners and by the end of 1900 coal will not be used as a fuel for locomotives on any of the lines in the state of California.

THE SCRAP HEAP.

Notes.

The Commissioner of Labor of the State of Montana reports that about 2,000 Japanese are employed as laborers on the railroads in that state.

The railroads of the Alabama iron region have agreed with the furnace men to make a reduction of 50 cents a ton on pig iron to all domestic points, but the application for a reduction on export rates is denied.

The Middle Division of the Pennsylvania Railroad is said to have once more beaten its own record in freight traffic, the number of cars passing Lewistown Junction on Sept. 22 being 7,029. Of these cars 3,938 were moved westward and 3,091 eastward; the number of trains was 115.

Mr. D. I. Roberts, General Passenger Agent of the Erie, has been selected to arbitrate a dispute regarding division of traffic from Prince Edward Island to New England points, which has arisen between the Canadian Pacific. The parties are the Boston & Maine on one side and the Intercolonial on the other.

Press despatches from Chicago this week indicate that Commissioner Donald has had a sharp fight with the ticket scalpers. Last week they had Mr. Donald arrested, charging larceny as bailee, the purpose being to get hold of forged tickets, deposited by the scalpers, which the agent had retained. One alleged detective, said to be connected with the scalpers, is held for trial on a charge of uttering forged railroad tickets and also for perjury. The trick of the scalpers in trying to imitate watermarked paper is told of in another column of this journal.

The railroads leading to Galveston, having combined their forces on the restoration of one bridge across the bay, finished a connection on Sept. 21, 12 days after the storm, and began running trains to and from the city. The bridge which was restored is 2⅛ miles long. Most of the piles were found standing, except at the draw opening and at a point where a large vessel was blown against the bridge in the storm. Much of the material for the new caps and flooring of the bridge had to be delivered on rafts, the track and roadbed having been destroyed for about eight miles north of the terminus of the railroad at the bay.

Near Athol, Idaho, on the night of Sept. 21 a passenger train of the Northern Pacific was entered by a robber who, single-handed, took from the passengers about $500 in money, besides watches and jewelry. The conductor of the train resisted the robber, but unsuccessfully. The express car of a through train of the Burlington road was robbed by four masked men near Woodlawn, Neb., on the 22d, but they did not open the through safe, and secured but little booty. Press despatches from Janesville, Wis., Sept. 23 report that on Saturday, near Merrimac, in that state, two men on a train of the Chicago & Northwestern were robbed by three men, who afterward threw them off the train. It is said that the robbers were afterward captured.

Rolling Stock for the Austrian State Railroads.

In 1898 the administration of the Austrian State Railroads laid out a programme, extending over a period of five years, for the purchase of rolling stock. Special at-

tention was paid to bringing about greater uniformity in passenger and freight cars. The programme includes, besides locomotives and passenger cars, 6,000 freight cars, 1,200 cars to be supplied during each of the five years. On account of the great lack in freight cars, which was keenly felt in 1899, and the first months of the present year, the administration made great efforts to reduce the time for the supply of the 6,000 cars to four years, and it succeeded in receiving the cars originally to be supplied in 1901 during the last few months. It has now been decided to urge the contracting car works to get the 1,200 cars for 1902 ready in 1901.

Austrian Cars for Tunis.

A few weeks ago a shipload, consisting of 120 freight cars for the Tunesian railroads, left Fiume for the port of Sfax, Tunis. All the cars were made and shipped by the Hungarian Car Works of Budapest. An additional shipment of 480 freight and 50 passenger cars will be made by the same works to Algeria. Both countries, Tunis, as well as Algeria, need more and better rolling stock. The Tunesian roads known as the Susa-Kairwan line (meter gage), 38 miles in length, and the Tunis-La Goletta-La Marsa-Le Bardo line (1.44 meter) are owned and worked by the Bone-Guelma Railroad Company, whose headquarters are at 7, Rue d' Astorg, Paris. Monsieur H. Desgrange is President of the Company, and Mr. A. M. Kowalski, Chief Engineer. This company now operates in Algeria 1,024 miles of 1.44 meter gage roads, and 269 miles of 1 meter gage lines. At the end of 1899 the rolling stock of these lines consisted of 105 locomotives, 218 passenger cars and 1,409 freight cars.

The Railroad Y. M. C. A.

Representatives of the Russian Government and of the German Government are in this country for the special purpose of studying the work of the railroad branches of the Young Men's Christian Association. It is said that the Czar and Prince Hilkoff are much interested in organizations for the greater comfort and care of railroad employees.

A Swiss Electric Railroad.

For 14 months there has been in operation a line of electric railroad between Burgdorp and Thun, in Switzerland. This line is standard gage, 25 miles long. The total ascent is 234 meters and the maximum grade 2.5 per cent. Each train consists of a motor car and a trailer and has 100 passenger seats. The motor car weighs 32 tons and the trailer 12 tons, and both have center aisles, according to the standard Swiss practice. The power is taken from a waterfall. The current is transmitted at 16,000 volts, the working voltage being 750. The trolley system of taking current is used. For freight business special locomotives of 300 h.p. and weighing about 30 tons are employed. These haul 20 tons additional to their own load at full speed on the steepest grades, and 70 tons at half speed. The note before us does not say, however, what full speed is.

Concerning Trade Catalogues.

The General Society of Mechanics and Tradesmen, No. 20 West 44th street, New York city, has added to its library a new department to be made up of catalogues concerning machinery, building, contracting, etc. These catalogues will be filed, indexed and accessible at all times to anybody desiring to consult them and will be a part of the library which now numbers over 1,000 volumes, and is free for consultation. We are requested to make this fact known to our readers.

Railroads in Corea.

The first railroad in the little Empire of Corea, from the seacoast at Chemulpo to the capital, Seoul, was opened for its whole extent July 8 last. The charter for this road was first granted to the President of the American Trading Co., James Morte, of Yokohama, who began work on the line in March, 1897; but in January, 1899, the charter was transferred to a Japanese corporation. A section of the road, 20 miles long, was opened September, 1899; a bridge 1,366 ft. long delayed the completion of the road, which is now 26 miles long, of 4 ft. 8½ in. gage, and has cost about $1,100,000.

A much more extensive undertaking is a railroad 300 miles long from Seoul southeast to Fusan, across the entire southern half of the Corean peninsula. This is also in the hands of a Japanese corporation, which expects that the Japanese government will guarantee its 6 per cent. bonds; and Japanese soldiers, it is said, will guard the construction, as Russian soldiers guard the Chinese Eastern Railroad through Manchuria. The cost of this line is estimated at $38,000 per mile. Japan is extremely anxious to establish its influence in Corea and keep Russia out.

A Shocking Tale From Paris.

Not long after the opening of the new electric underground railroad in Paris, the electric current on the conductor rail suddenly ceased, the trains were left in total darkness and moved only by the momentum which they had attained before the current ceased. This was sufficient to bring all but one of them to the nearest station. That one came to a halt between the Lyons station and the Bastille, and the terrified passengers made their way on foot in the darkness to the Bastille station. The cause of all this was that a bar on a car had got loose and fallen across the rails, short-circuiting the current, which was thus interrupted for 40 minutes.

To Mecca by Rail.

The pilgrimage to Mecca is to be made easier by a railroad from Damascus to Mecca, which is to be prosecuted as a purely pious enterprise. The capital is to be provided by popular subscriptions, and in order that the burden may not fall wholly on the poor, every government employee and officer in the whole Turkish empire is advised to subscribe a month's salary; and lest he may forget, the amount will be collected by the treasury, which will retain 10 per cent. of the pay until the amount is made up. None but the faithful will be permitted to work at the construction of the line, and 2,000 infantry will be detailed for the earthwork. The line may not vary from the road followed by caravans of pilgrims for something like a thousand years. Work was to have begun on the last day of August, which is the anniversary of the Sultan's accession to the throne.

A Pipe Line to the Black Sea.

The long-continued efforts to lay a pipe line to carry Caspian petroleum to the Black Sea have at last resulted in the completion of a line 142 miles long from the Black Sea end at Batum to the station Michailovo, about one-quarter of the distance to the Caspian. The shipments are said to have become too great for the railroad to handle, and it was cheaper to lay the pipe line than to improve the railroad; but it seems that the latter must still carry the oil over the 418 miles from Baku to Michailovo. In the latter place storage tanks with a capacity of 75,000 bbls. are provided; at each of two intermediate points on the pipe is tankage for 56,000 bbls., and at Batum, the Black Sea port, the tanks hold 106,000 bbls. All these stations are provided with Worthington pumps of 400 h.p., and at Batum there are two, each of which can discharge 125,000 gals. per hour into a tankship. The cost of the line is said to have been $2,600,000. The delay was due to the determination to make the pipe (8-in.) in Russia, where previously there was no such industry.

Rolling Stock, Bridge and Material for French Indo-China.

The Ministry of the Colonies is inviting bids for large amounts of railroad material to be used for construction in French Indo-China. Bids will be received for the following work and material: On Oct. 20, 1900. Construction of the roadbed from Haiphong to Hanoi and Lao-Kay, and a section from Haiphong to Vietri. Nov. 1, 1900. Material (rails, sleepers, etc.,) for the above lines, and also for a line from Hanoi to Vink, and from Hanoi to Ninh-Binh. Nov. 9, 1900. Construction of the roadbed from Hanoi to Ninh-Binh and from Saigon to Tan Linh. Nov. 16, 1900. Construction (including buildings, etc.,) of the line Saigon-Khanhoa-Lang-Bian. Dec. 14, 1900. Large bridges, turntables, and rolling stock for the different new lines in Indo-China. For all further information application should be made (in French) to Inspection Générale Des Travaux Publics, Ministére Des Colonies, Paris, France.

LOCOMOTIVE BUILDING.

The Southern Pacific has recently ordered 10 engines from the Baldwin Locomotive Works.

The Boston & Maine is having four engines built at the Manchester Locomotive Works.

The Grand Rapids & Indiana has ordered four engines from the Pittsburgh Locomotive & Car Works.

The Seaboard Air Line is having two engines built by the Pittsburgh Locomotive & Car Works.

The Burlington, Cedar Rapids & Northern has ordered five locomotives from the Brooks Locomotive Works.

The Rio Grande Western is reported to have ordered a number of locomotives from the Schenectady Locomotive Works.

The Chicago, Burlington & Quincy is reported as soon to be in the market for locomotives. We have no official information.

The Davenport, Rock Island & Northwestern, referred to last week, has prepared specifications for some new eight-wheel passenger engines which call for 18-in. x 24-in. cylinders, 72-in. driving wheels, wagon top boilers with a working steam pressure of 180 lbs., Westinghouse brakes, Sterlingworth brake-beams, Chicago couplers and Nathan injectors.

The Rio Tinto Co., Ltd., of Spain (a mining company), has ordered six switching locomotives, Class 8-26 E 5 to 10, from the Baldwin Locomotive Works. The specifications call for 16-in. x 22-in. cylinders, 42-in. driving wheels, boilers 48 in. in diam. with 146 tubes 11 ft. 7 in. long and 1¾ in. in diam., and a working steam pressure of 180 lbs.; fire-boxes, copper, 77 3-16 in. long and 29⅞ in. wide; and heating surface, fire-box 86 sq. ft., tubes 775 sq. ft. The engines will weigh 89,000 lbs., have a tank capacity for 1,000 Imp. gals. of water and will be delivered between January and March, 1901.

The Kansas City Southern order with the Baldwin Locomotive Works, referred to last week, calls for 10 compound consolidation freight engines. Two of these were shipped Sept. 15. The specifications call for 15½ in. and 26-in x 30-in. cylinders, 55-in. driving wheels, boilers 70 in. in diam. with a working steam pressure of 200 lbs., and 306 tubes 2 in. in diam. and 13 ft. 6 in. long; heating surface, fire-box 193.9 sq. ft., tubes 2,147.9 sq. ft., firebrick tubes 25.4 sq. ft.; fire-boxes, steel, 120 3-16 in. long and 40⅜ in. wide; weight of engine, 183,010 lbs., with 158,230 lbs. on the driving wheels; and tender capacity, 5,000 gals. of water. The engines will burn soft coal.

The Lake Shore & Michigan Southern gave an order to the Brooks Locomotive Works early in July for two large passenger engines with wide fire-boxes. In many details the engines will be the same as the 10-wheel passenger engines now running on that road. A two-wheeled truck will, however, be substituted for the four-wheeled leading truck and there will be a two-wheeled radial truck under the fire-box, making the engine similar to the "Prairie" type. The engines will have three pairs of 80-in. drivers, 20-in. x 28-in. cylinders, 49 sq. ft. of grate and about 3,250 sq. ft. of heating surface; the boilers will carry 200 lbs. pressure. Total weight of engine is estimated at 174,000 lbs., of which 128,000 lbs. will be on the drivers. The engines will be delivered early in December.

The Government Railroads of New Zealand have ordered from the Baldwin Locomotive Works 10 10-wheel freight engines, Class 10-26 D 161 to 170, and 12 passenger locomotives, Class 12-22¼ D 5 to 16, all for delivery in January, 1901. The former will weigh 79,000 lbs., with about 59,000 lbs. on the driving wheels, and have 16-in. x 20-in. cylinders; 49-in. driving wheels; balanced piston valves; boilers, 52 in. in diam., with a working pressure of 200 lbs., and 177 tubes 2 in. in diam. and 13 ft. 4½ in. long; heating surface, fire-box, 90 sq. ft., tubes 1,231 sq. ft.; and tender capacity, 2,000 gals. of water. The passenger engines will weigh 95,000 lbs., with 63,000 lbs. on the driving wheels and have 14-in. x 20-in. cylinders, 39¾-in. driving wheels, boilers 50 in. in diam. with a working steam pressure of 200 lbs., and 177 tubes 1¾ in. in diam. and 9 ft. 5 in. long; and tank capacity, 1,078 gals. of water.

CAR BUILDING.

The Vermont Central is reported in the market for 100 coal cars.

The Southern Indiana has ordered 500 freight cars from the Barney & Smith Car Co.

The Wrightsville & Tennille recently ordered one passenger car from the Barney & Smith Car Co.

The Chihuahua & Pacific has ordered one passenger car from the Barney & Smith Car Co.

The Baltimore & Ohio is reported in the market for from 3,000 to 10,000 coal and box cars.

The Burlington, Cedar Rapids & Northern is having six cars, for passenger service, built by the Pullman Co.

The Continental Fruit Express Co. has ordered 200 refrigerator cars from the American Car & Foundry Co.

The Atchison, Topeka & Santa Fe has ordered eight cars for passenger service from the Barney & Smith Car Co.

The Merchants Despatch Transportation Co., New York, is asking prices on material for 150 cars which are to be built in their own shops.

The American Car & Foundry Co. has received orders for 150 freight cars, for hauling ore, from Spain, and for 20 sugar cane cars from Cuba.

The Union Pacific has ordered 480 steel ballast cars of 110,000 lbs. capacity and 300 coal cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The Webster Coal & Coke Co. has ordered 250 mine cars from the American Car & Foundry Co., delivery to begin at once. These cars will have a capacity of about one ton each and will be used in the soft coal mines of the company at Ehrenfeld, Pa.

The Tennessee Central has ordered 150 hopper bottom gondolas, 150 flat bottom gondolas, 50 side dump cars and some passenger equipment from the American Car & Foundry Co. The trucks and bolsters will be furnished by the American Steel Foundry Co.

The Lake Shore & Michigan Southern informs us that it is not in the market for steel cars. The order with the Barney & Smith Co. for four postal cars (two letter and two paper), as noted last week, calls for December delivery. These cars will be of the standard type of the road, 60 ft. long, with four-wheel steel trucks.

The Davenport, Rock Island & Northwestern expects to place an order for some steel cars within a week or 10 days. Last week we made some reference to this order. The specifications call for 50 coal cars of 100,000 lbs. capacity and 25 flat cars of 80,000 lbs. capacity, to be delivered Dec. 15. The special equipment will include Bettendorf bolsters, Sterlingworth brake-beams and Chicago couplers.

BRIDGE BUILDING.

Alexandria, La.—The Geo. E. King Bridge Co., of Des Moines, Ia., has the contract to build a steel bridge across the Red River for the Alexandria & Pineville Bridge Co. The bridge is to be 850 ft. long. The approaches are 14 ft. on the Alexandria side and 50 ft. on the Pineville side. It will be of five spans, the roadway being 18 ft. 8 in. wide. A sidewalk on either side is 5 ft. wide.

Buffalo, N. Y.—The South Buffalo Ry. Co. has permission to build bridges across Tifft and Marilla streets. The plans for the bridge over Buffalo River will be altered. John G. Milburn represented the railroad company.

Cedar Falls, Iowa.—The Board of Supervisors have appropriated $20,000 for a new bridge across Cedar River.

Charlottetown, P. E. I.—We are informed that Mr. M. J. Haney, of Toronto, Ont., has the contract for the steel bridge over the Hillsborough River, in connection with the extension of the Prince Edward Island Ry. to Murray Harbor. The cost will be about $1,000,000.

Cincinnati, Ohio.—The plans for the proposed bridge at Spring Grove avenue, over Mill Creek, have been approved by the Board of Public Safety. The estimated cost is $49,250.

Delphi, Ind.—The Carroll County Commissioners want bids, Oct. 1, for six county bridges. James C. Smock, County Auditor.

Doylestown, Pa.—Bids are wanted, Oct. 15, by the Commissioners of Bucks County for a stone bridge at Kaber's Ford. Elmer E. Funk, Clerk to the County Commissioners.

Helena, Mont.—Proposals will be received, until Oct. 1, by Chas. J. Clark, County Clerk, for three bridges on the road to be changed from Canyon Ferry up the east shore of Lake Sewell.

Islington, Ont.—The Etobicoke Township Council will build two steel bridges—one of 125 ft. over the Humber River, and the other, 50 ft., over Mimico Creek.

Joliet, Ill.—The City Council is reported to have received the following bids for two bridges over the canal: (1) Exchange street bridge, (2) Jackson street bridge. The Toledo Bridge Co., (1) $16,900, (2) $18,000; Milwaukee Bridge & Iron Works, (2) $17,600; Massillon Bridge Co., (1) $14,500; (2) $16,000; Joliet Bridge & Iron Co., (1) $12,500 and $15,000, (2) three bids from $14,800 to $15,900.

Newport, Ind.—The Vermillion County Commissioners want bids, Oct. 3, for two bridges. Wm. P. Ellb, County Auditor.

Parkersburg, W. Va.—We are informed by the Baltimore & Ohio that the company has no intention of rebuilding its bridge over the Ohio River at Parkersburg.

Wm. Kirk, President of the Little Kanawha Bridge Co., is reported as stating that a proposition has revived to build a footbridge across the Kanawha River at a probable cost of $10,000.

Philadelphia, Pa.—The Commissioners of Fairmount Park ask for $100,000, in their annual estimate, to build an ornamental bridge of iron or stone across Lansdowne Glen, West Park.

Bids will be opened, Oct. 2, in the office of Chief Engineer Webster, of the Bureau of Surveys, for a steel bridge to replace the wooden structure on the line of Coulter street, over the Chestnut Hill branch of the Pennsylvania. The estimated cost is $24,000.

Piqua, Ohio.—See Troy, Ohio.

Robson, B. C.—The Canadian Pacific Ry. will bridge the Columbia River at this place.

Salem, Ind.—Bids are wanted, Oct. 2, for a bridge on Charlestown Road. Geo. R. McCoy, Trustee, Franklin Township, Washington County.

Seabright, N. J.—The Board of Chosen Freeholders of Monmouth County have decided to rebuild the bridge over the Shrewsbury River at Seabright. The cost to repair the present bridge is estimated at $19,000. A new bridge will cost about $60,000.

Syracuse, N. Y.—The Havana Bridge Works, of Montour Falls, N. Y., has the contract for the state bridge over the canal in Syracuse at $19,974.50.

Toledo, Ohio.—The City Engineer informs us that the city does not contemplate building a viaduct over St. Clair street, as reported.

Townsend, Mont.—At a meeting of the County Commissioners, Sept. 15, the plans for the new bridge over

the Missouri River at or near Hedges Ferry, about six miles southeast of Winston, were considered; also the advisability of asking bids for Dec. 3. John H. Farmer, County Surveyor, Helena.

TROY, OHIO.—Bids received in the early part of the month for two steel hoist bridges, one at Troy and the other at Piqua, have been rejected by the County Commissioners. Other bids are wanted, Oct. 13. J. T. Bartmess, County Auditor.

UNIONVILLE, MO.—Bids are wanted, Oct. 2, by the County Commissioners for bridges, as follows: Elm Township, 60-ft. bridge with 42-ft. approaches; 40-ft. bridge with 36-ft. approaches and a 22-ft. platform bridge with 12-ft. approaches; Lincoln Township, 48-ft. bridge with 48-ft. approaches; York Township, platform bridge with two 14 and two 12-ft. spans. A. F. Davis, Bridge Commissioner.

WASHINGTON, D. C.—Proposals for a Melan arch bridge across Rock Creek, on the line of Quarry Road, will be opened, Oct. 13, at the office of Lansing H. Beach, Engineer Commissioner, D. C. (Aug. 10, p. 544.)

WEST FAIRVIEW, PA.—The Northern Central Ry. (Pennsylvania R. R.) will replace the wooden bridge over the Conondoguinat Creek by a steel deck bridge of two spans, the total length to be 260 ft. The contract is let to the A. & P. Roberts Co.

Other Structures.

ATLANTA, GA.—The railroads interested in the proposed union depot at Atlanta will submit their final proposition to the Special Legislative Depot Commission, Oct. 5.

CHESTER, PA.—The Keystone Tube Co. has been chartered in New Jersey, and, according to report, will build a pipe and tube mill at Chester, Pa. The incorporators are: Geo. M. Keasby, David L. Howell and Wm. A. Calhoun, the latter of Newark, N. J.

KANSAS CITY, MO.—Reports state that the Chicago, Rock Island & Pacific has bought property on Genesee street, between Fourteenth and Fifteenth streets, for a freight depot.

LITTLE ROCK, ARK.—The St. Louis, Iron Mountain & Southern shops at Baring Cross were destroyed by fire, Sept. 25, causing a loss of about $250,000.

MORGAN, TEX.—The Gulf, Colorado & Santa Fe Ry. is building a joint combination freight and passenger depot, two stories high, 24 x 120 ft., at Morgan.

READING, PA.—The Reading Iron Works will build a 75 x 108 ft. addition to the pipe mill.

SAN FRANCISCO, CAL.—The new ship building plant for the Risdon Iron Works, at San Francisco, will be built by the American Bridge Co., of New York. The plant will consist of a boiler shop, machine shop and foundry.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

Western Society of Engineers.

At a meeting of the Western Society of Engineers, Wednesday evening, Sept. 19, Mr. E. Lee Heidenreich read a supplemental paper on "Monier Constructions," giving the different formulas used in the calculations of such work. At the regular meeting, Oct. 3, Mr. J. W. Schaub will present a paper on "Proposed Specifications for Steel Railroad Bridges."

Northwest Railway Club.

At the September meeting Mr. E. A. Williams, Mechanical Superintendent of the "Soo" Line, Minneapolis, Minn., was elected President, succeeding Mr. Geo. D. Brooke, resigned. The other officers are: First Vice-President, A. Lovell, S. M. P., N. P. Ry., St. Paul; Second Vice-President, G. H. Goodell, Mechanical Engineer, N. P. Ry., St. Paul; Secretary and Treasurer, T. A. Foque, Assistant Mechanical Superintendent, "Soo" Line, Minneapolis; Assistant Secretary, F. B. Farmer, Westinghouse Air-Brake Co., St. Paul.

New York Railroad Club.

On Thursday evening of last week the New York Railroad Club held the first meeting of the autumn season.

The President mentioned the proposition to amend the constitution in such way as to make three members of the Finance Committee also members of the Executive Committee, the reasons for which change are sufficiently obvious.

The paper of the evening was by Mr. John A. Secor, President of the General Power Co., and was entitled "Some Recent Developments in Internal Combustion Engines." Mr. Secor went very briefly but clearly over the history of internal combustion engines, their theoretical and actual advantages, the difficulties of operation which they have presented and the means by which these difficulties had gradually been remedied. Then by lantern slides he showed the main features in the design of the petroleum engine, built by his company, which was described, with illustrations, in the *Railroad Gazette* of July 20. The paper was discussed by Messrs. Prout, Hansel, Strong and Whitney, Mr. Secor closing the discussion. The attendance was very large.

The title of the paper for the October meeting will be announced later.

Western Railway Club.

A meeting of the Western Railway Club was held Tuesday afternoon, Sept. 18, at the Auditorium Hotel, Chicago. The Secretary read the names of 22 new members, after which two papers were discussed quite fully. The first was by Prof. R. A. Smart, of Purdue University, entitled "The Friction of Brake Shoes Under Various Conditions of Pressure, Speed and Temperature," and extracts from this paper will be found on another page. There was some discussion of the proposed M. C. B. specifications for brake shoes, and, evidently, it is the present opinion of the Chairman of the M. C. B. committee, Mr. S. P. Bush, that those specifications should favor brake shoes having a high coefficient of friction. This is directly opposed to the present practice of most roads, but is doubtless the proper course.

Mr. G. R. Henderson's paper, "A Schedule for Apprentices," described a plan used in the Chicago & Northwestern shops so that apprentices will be moved from one department to another according to a prearranged plan. The discussion brought out some interesting remarks from Prof. Goss, of Purdue University, to the effect that the small inducements for technical graduates to enter the mechanical departments of railroads as special apprentices had brought about a peculiar state of affairs. That what directors of technical schools considered their best men were no longer going into railroad service, but were being taken by large manufacturers. In this way the railroads were largely getting what was left over. Various industrial companies offer equal facilities with railroads for getting a useful experience while the compensation is greater as well as the opportunity for rapid advancement.

At the next meeting, Oct. 16, Mr. G. W. Beebe, Wheel Inspector of the Chicago, Burlington & Quincy, will read a paper on "Cast Iron Wheels," and Mr. A. Bement, Chemist, Chicago, will have a paper entitled "Smokeless Gases in Fire-Boxes."

International Association for Testing Materials.

The third annual meeting of the American Section will be held in New York, N. Y., on Thursday, Friday, and Saturday, Oct. 25, 26 and 27, 1900. The sessions will be held at the House of the American Society of Mechanical Engineers, 12 West Thirty-first street, beginning at 3 p. m. on Oct. 25. The first session will be occupied by remarks by the Chairman, report of the Secretary, report of the Treasurer, report of the Publication Committee, report of the Executive Committee regarding the increase of membership of Committee No. 1, report of the Executive Committee regarding the representation of the American Section on the International Council, proposed amendments to the By-Laws, election of officers for 1900-1902, and miscellaneous business. In the evening there will be an informal dinner at 6:30, and a session at 8:30 for the report of Committee No. 1, and discussion of the Specifications for Structural Steel for Buildings, Structural Steel for Bridges and Ships, and Open-hearth Boiler Plate and Rivet Steel recommended by the American Branch of Committee No. 1.

Oct. 26, 10 a. m., reports of Committees Nos. 2, 3, 4, 5 and 6, and discussion of the Specifications for Steel Rails and Steel Splice Bars recommended by the American Branch of Committee No. 1.

Oct. 26, 3 p. m., reports of Committees Nos. 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16, and discussion of the Specifications for Steel Axles, Steel Tires, and Steel Forgings recommended by the American Branch of Committee No. 1.

Oct. 26, 8:30 p. m., reports of Committees Nos. 17, 18, 19, 20 and 22, and discussion of the Specifications for Steel Castings and Wrought Iron recommended by the American Branch of Committee No. 1.

Oct. 27, 10 a. m., report of the American Committee on Impact Tests; report of the American Committee on Basic and Acid Open-Hearth Steel; report of the American Committee on Proper Heat Treatment for Iron and Steel; report of the American Committee on the Relation Between Chemical Composition and Physical Properties of Iron and Steel; report of the American Committee on the Electrical Testing of Metals.

The British Association for the Advancement of Science.

This Association met at Bradford, England, week before last and we find in the English papers a remarkably complete account of the papers and discussions from which we make a few notes. The British Association is a good deal less of a cave of Adullum than the American Association for the Advancement of Science, but even there a good many Adullumites wander in. It seems to be impracticable to keep out the vague, the speculative, the disappointed and all those who have no definite place in the world. At the same time some wise men present sensible papers and say sensible things in the discussion.

At the Bradford meeting a Mr. Aldridge read a paper on "Electric Trolley Omnibuses." His proposition is to use electric omnibuses in the streets of towns, but to let them run free with no rails in the streets. He would take current from wires carried alongside the street by means of a trolley fast to and running on these wires, propelling itself by a little electric motor. This trolley is connected by a cable to the omnibus, giving the omnibus a considerable range of action. This system is in actual use in the outskirts of Paris. Lantern slides showed an omnibus threading its way through heavy traffic, turning circles, reversing its action, two omnibuses meeting and exchanging cables, etc. Slides snowed an installation at work in the park at Vincennes at the Paris Exhibition.

Sir W. H. Preece, F.R.S., read a paper on "The Manchester & Liverpool Express Railway," this being the projected single rail line of Mr. Behr. It will be remembered that this enterprise has been held up by failure to get the necessary parliamentary powers.

Mr. Behr himself read a paper on "Brakes and Signals," in which he described what he considers to be the requirements for a railroad working trains at 110 miles an hour, and the means which he proposes to use to meet these requirements on his Manchester & Liverpool Railroad.

Mr. A. Mallock read a paper on "The Measurement of the Tractive Force, Resistance and Acceleration of Trains." A short synopsis of that paper follows: The author described in the paper some experiments recently made on electric and other railroads, the object of the experiments being to determine the acceleration, tractive force, and running resistance to which the trains are subject. The appliance used was a short pendulum whose free vibrations are adequately damped. If this is suspended on the moving body it will hang in the direction which is the resultant of gravity and the acceleration which the body at the time experiences; hence the angle which such a pendulum makes with the vertical gives the measure of the accelerations at each instant. In the experiments the penduium was arranged so as to record its position on uniformly moving paper, on which at the same time seconds were marked by an electric clock, and a contact marker, worked from one of the wheels of the carriage, caused a second pen to record each revolution performed by the wheel. The diagram thus obtained gives a direct measure of the speed and acceleration of the carriage.

Mr. T. Barker read a paper on "The Basis of Charging for Electric Current," he, with Prof. Ewing, having devised a meter for the purpose of registering the current taken by consumers of electricity.

Prof. A. W. Rücker, Secretary of the Royal Society, was elected President of the association. The next meeting will be held at Glasgow Sept. 11, 1901. The meeting of 1902 will be held at Belfast.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. Charles S. Tappen, at one time General Manager of the New York, Chicago & St. Louis Fast Freight Line at Rochester, died Sept. 21. He was born in New York, Dec. 29, 1820.

—Mr. Edward C. Tomlinson has resigned as Superintendent of the New York Division of the Philadelphia & Reading, being succeeded by Mr. W. A. Garrett. Mr. Tomlinson was born in Pennsylvania in 1857 and entered the service of the Reading in 1872, where he has been operator, Yardmaster, Train Dispatcher, Trainmaster and Division Superintendent. All of his working life has been with the Reading.

—Mr. William Forsyth has been appointed Mechanical Engineer of the Pennsylvania Coal Co., with headquarters at Scranton, Pa. This is effective Oct. 1, but Mr. Forsyth is now inspecting machinery in the various collieries of the company. Since Mr. Forsyth left the service of the Northern Pacific as General Superintendent of Motive Power he has been considerably employed in consulting engineering, the last important work that he has done, so far as we know, being plans for a locomotive repair shop for the Buffalo, Rochester & Pittsburgh, at Du Bois, Pa.

—Mr. Watts Cooke, President of the Passaic Rolling Mills Co., died Sept. 25 at his summer home in Wyckoff, N. J. Mr. Cooke was born in Matteawan, Dutchess County, N. Y., in 1833, and went to Paterson, N. J., in 1839. He spent three years with Mr. John Ryle in the silk business at that place, and later learned locomotive building with Rogers, Ketcham & Grosvenor. He was at one time foreman at the Danforth-Cooke locomotive shops, and later Master Mechanic of the Delaware, Lackawanna & Western. In 1867 he founded what is now the Passaic Rolling Mills Co.

—Mr. Edwin M. Bushnell, Vice-President and General Manager of the United States Railway Supply Co., New York, died at his home in Brooklyn, N. Y., Sept. 24, aged 39 years. Mr. Bushnell's acquaintance with railroad officers, especially those in the purchasing and mechanical departments, was large. For several years he managed the business of the Bushnell Mfg. Co., at Easton, Pa., which then made Bushnell car seats and springs. Mr. Bushnell enjoyed to a high degree the confidence of those with whom he came in contact. He was straightforward and frank, and had many warm friends.

—The resignation is announced of Mr. I. A. Sweigard, General Superintendent of the Philadelphia & Reading Railroad. Mr. Sweigard is a Pennsylvanian by birth and is a little more than 57 years old. He has been in railroad work since August, 1864, having passed his whole life on the Reading and its auxiliary lines. He has gone through the various grades of Station Agent, Train Dispatcher, Superintendent and General Superintendent, and for a time held the title of General Manager of the Philadelphia & Reading System. He is succeeded now by Mr. W. G. Besler, Superintendent of the Reading Division.

—Mr. Alexander McBurney Byers died at the Holland House, in New York city, last week. Mr. Byers was a rich and successful business man of Pittsburgh, Pa., an iron and steel maker and President of the Iron City National Bank. He was one of the organizers with Mr. George Westinghouse, of the Philadelphia (natural gas) Company, of Pittsburgh, was a Director in the Westinghouse Air-Brake Co., in the Westinghouse Electric & Mfg. Co., and in the Union Switch & Signal Co. He was born in Mercer County, Pa., in 1827, had a limited education, and began work in the iron business when very young. In 1857 he became connected with the firm of Spang & Co., of Pittsburgh, and a few years later formed a partnership with his brother as A. M. Byers & Co., to make wrought iron pipe. From that time his career has been one of steady and growing importance.

—Mr. W. A. Garrett has been appointed to succeed Mr. E. C. Tomlinson as Superintendent of the New York Division of the Philadelphia & Reading Railroad. He is now Superintendent of the Philadelphia Division. Mr. Garrett was born in 1861 in Mississippi and began railroad work on the Ohio & Mississippi in 1876. He passed through various grades and from March, 1893, to Jan. 1, 1896, was Superintendent of the Terminal Railroad Association at St. Louis. During most of this time he was also Superintendent of Terminals of the Wabash Railroad at St. Louis, and part of the time of the St. Louis Merchants' Bridge Terminal Railway. Jan. 1, 1896, he was made Superintendent of the Western Division of the Wabash, and in July, 1899, he became Superintendent of the Philadelphia Division of the Philadelphia & Reading.

—Mr. B. L. Winchell, the new President and General Manager of the Kansas City, Fort Scott & Memphis and Associated Lines, began his railroad career in 1873 with the Hannibal & St. Joseph in the mechanical department. From there he went with the Atchison & Nebraska as chief clerk in the general freight office, and in 1879 became Assistant General Passenger Agent. In April, 1880, he was made chief clerk in the passenger department of the Kansas City, Fort Scott & Gulf. The following two years he was Assistant General Passenger Agent of the same company, and in 1895 General Passenger Agent of the Union Pacific, Denver & Gulf. After that company was reorganized as the Colorado & Southern, Mr. Winchell became its Vice-President in charge of traffic, which position he held until his recent appointment.

—Mr. Edwin M. Rine is the Acting Superintendent of the Scranton Division of the Delaware, Lackawanna & Western at Scranton, Pa. He was born at Brilliant, Ohio, Sept. 4, 1867. He entered railroad service as a telegraph operator for the Pennsylvania Company in 1886. He served later as Train Despatcher, and for three years, from 1889, he was Train Despatcher of the Cleveland Terminal & Valley. He was then promoted to Chief Despatcher. In 1896 he was made Trainmaster of the Akron Division of the Baltimore & Ohio. After serving with that company until October, 1899, he entered the service of his present company, the Delaware, Lackawanna & Western as Train Despatcher until Nov. 20 of the same year; then as Chief Despatcher until Aug. 20 last. His latest advancement as Acting Superintendent took effect Sept. 18.

—Col. Joseph H. Wood, who, from 1880 to a recent date, was Assistant to the General Manager of the Chicago & Alton, died suddenly Friday night, Sept. 21, at his home in Chicago. Col. Wood was born June 3, 1838, at Watertown, N. Y., and was educated at the Black River Literary Institute. His first railroad service was in 1855, as station agent of the Potsdam & Watertown. Later he was with the engineering corps on the New York canals and subsequently engaged in the contracting business. After serving during the Civil War, Col. Wood was an officer in the U. S. army until 1867, when he again became a contractor on railroad and public works. From 1876 to 1880, he was a Division Superintendent of the Alton, and in 1880 was made Assistant to the General Manager, retiring a short time ago, when that road was brought under a new management.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—F. W. Cox has been appointed General Machinery Inspector, with headquarters at Baltimore, Md.

Boston & Maine.—D. E. Davis has been appointed General Foreman.

Central Vermont.—The line from Windsor, Vt., to White

River Junction, will, on Oct. 1, be included in the Southern Division. First District.

Charleston & Savannah (Plant System).—C. S. Gadsden, heretofore Superintendent of the Plant System, has been elected President of the C. & S., effective Oct. 1.

Chicago, Indianapolis & Louisville.—At a meeting of the stockholders, held Sept. 19, C. Steele was elected a Director, succeeding the late C. H. Coster.

Chicago, Milwaukee & St. Paul.—At a meetng of the stockholders, held Sept. 22, James H. Smith was elected a Director, succeeding C. H. Coster, deceased.

Cincinnati, Richmond & Muncie.—W. I. Allen has been appointed General Manager, with headquarters at Richmond, Ind., and J. J. Archer, General Freight and Passenger Agent.

Colorado Midland.—W. S. Wing, Auditor, will also assume the duties of Comptroller, succeeding L. G. Cannon, resigned.

Delaware, Lackawanna & Western.—C. J. Phillips has been appointed General Agent, with headquarters at Bangor, Pa., in charge of the operation and traffic of the Bangor & Portland, taken over by the D., L. & W., on Aug. 1. Effective Sept. 20. (See R. R. News column, Aug. 10, p. 546.)

Grand Trunk.—Geo. C. Jones has been appointed Superintendent of the Eastern Division, with headquarters at Montreal, P. Q., succeeding J. M. Herbert, resigned. F. W. Egan has been appointed Superintendent of the Middle Division, with headquarters at Toronto, Ont., succeeding Mr. Jones. A. S. Begg has been appointed Assistant Superintendent, with headquarters at London, Ont., and in turn is succeeded by C. S. Cunningham as Superintendent of the St. Clair Tunnel and Terminals, with headquarters at Port Huron Tunnel, effective Sept. 20.

Jackson, Columbus & Northwestern.—The officers of this company, referred to in the Construction column, are: President, Newman Cayce, Columbus, Miss.; Vice-President, T. W. Brame, Macon, Miss.; Secretary, Edgar S. Wilson, Jr., Jackson, Miss.; Treasurer, W. M. Anderson, Jackson.

Kansas City, Fort Scott & Memphis.—B. L. Winchell, heretofore Vice-President and Traffic Manager of the Colorado & Southern, has been elected President and General Manager of the K. C., F. S. & M., and Associated Lines, assuming the duties about Oct. 15. Mr. Winchell succeeds the late Edward S. Washburn.

Marion & Rye Valley.—The officers of this company, recently reorganized, are: President, T. L. Woodruff; Secretary and Treasurer, G. W. Miles, and General Manager, J. L. Woodruff.

Midland of Nova Scotia.—H. V. Harris has been appointed General Manager, with headquarters, temporarily, at Windsor, N. S. (See Construction Supplement, July 27, 1900.)

New York, New Haven & Hartford.—F. W. Cheney has been elected a Director, succeeding the late Henry C. Robinson.

Philadelphia & Reading.—W. G. Besler, heretofore Superintendent of the Reading Division, has been appointed General Superintendent, with headquarters at Reading, Pa., succeeding I. A. Sweigard, resigned. W. A. Garrett, heretofore Superintendent of the Philadelphia Division, succeeds E. C. Tomlinson, resigned, as Superintendent of the New York Division.

Plant System.—The Division Superintendents, after Oct. 1, will be as follows: W. H. Wright, First Division, with headquarters at Savannah, Ga.; succeeding C. S. Gadsden; Geo. W. Haines, Second Division, at Waycross, Ga.; D. F. Kirkland, Third Division, at Thomasville, Ga.; S. S. Fitzsimmons, Fourth Division, at Montgomery, Ala.; H. A. Ford, Fifth Division, at Gainesville, Fla.; and J. J. Purdon, Sixth Division, at Sanford, Fla.

Seattle & Tacoma Electric.—The officers of this company, referred to in the News column, are: President, Jacob Furth, Seattle, Wash.; Vice-President and General Manager, Geo. B. Blanchard, Tacoma; Treasurer, W. C. Forbes, Boston, Mass.

St. Johnsbury & Lake Champlain.—The officers of this company are: President, H. E. Folsom; Vice-President, H. N. Turner, and Treasurer, George W. Cree.

Southern Missouri & Arkansas.—E. F. Blomever has been appointed Second Vice-President and Traffic Manager, and is succeeded as Auditor by W. N. Terry. Van R. Caldwell, heretofore Cashier, has been appointed Purchasing Agent.

Toluca, Marquette & Northern.—The officers of this company, referred to in the Construction column, are: President and Chief Engineer, Charles J. Devlin, Topeka, Kan.; Vice-President, J. S. Wylie, Davenport, Iowa; Secretary, H. Duggan, Toluca, Ill.; Treasurer, W. A. Stephens, Magnolia, Ill.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BALTIMORE & OHIO.—Building is in progress on a cut-off from Washington Junction, Md., to Adamstown.

BOSTON & MAINE.—A petition was filed by this company in the New Hampshire Supreme Court, Sept. 24, for authority to build an electric road from Concord, N. H., to Nashua.

CALDWELL & NORTHERN.—This line, which runs from Lenoir, N. C., on the Carolina & Northwestern, west 10.6 miles to Collettsville, is reported to have completed surveys for an extension west to Chester, and it is probable that building will be begun soon.

CANADIAN PACIFIC.—Surveyors are staking out a new line from a point about 1½ miles west of Agincourt, Ont., to run northeast about 18 miles to Claremont. The new line will avoid a number of grades and curves and will touch the town of Markham.

CENTRAL VERMONT.—A contract is reported let for a branch from the main line west about 10 miles to Rochester, Vt.

CHARLESTON IMPROVEMENT & TERMINAL.—This new company is endeavoring to obtain a franchise for a belt line in Charleston, W. Va. A. Cormack is one of the promoters.

CHESAPEAKE & OHIO.—The company is building 50 miles of second track in West Virginia. (Sept. 21, p. 628.) Thirty miles have been completed and building is in progress on the other 20 miles to be completed in a few months. (Official.)

DEQUEEN & EASTERN.—This company has been incorporated in Arkansas, with a capital stock of $280,000, to build a railroad from Dequeen northeast about 40 miles to Murfreesboro, on the Arkansas Southwestern. The incorporators are: Hans Dierks, M. L. Turner, Kansas City, Mo.; Herman Dierks, Peter Dierks, Lincoln, Neb.; Harry Large, W. A. Prater, Herbert Dierks, Dequeen; Travis Pope, Center Point, Ark.; M. F. Allen, Holcolm, Ark.; Smithson T. Watkins, Corinth, Ark.

GREAT FALLS & CANADA.—The company has begun building its St. Marys River line from Sterling, N. W. T., south 30 miles to Spring Coulee. It is stated that about ten miles is graded. (St. Mary's River Ry. & Colonization, Construction Supplement, July 27, 1900.)

GREAT NORTHERN.—The company is reported completing its tunnel, about one-half mile long, under the city of Everett, Wash. When completed it will shorten the main line by some four or five miles.

GREENVILLE, NASHVILLE & CHATTANOOGA.—This company has been incorporated in Mississippi and Tennessee to build a line from Greenville, Miss., north to Nashville, Tenn. The capital stock is $5,000,000. The incorporators are F. L. Bates, Greenville, Miss.; John H. Rice, Kansas; James H. Hackett, Illinois.

INTERNATIONAL TRACTION COMPANY.—This company has been organized to build another electric railroad between Buffalo, N. Y., and Rochester.

JACKSON, COLUMBUS & NORTHWESTERN.—This company, whose organization was noted last week (p. 628), proposes to build from Jackson, Miss., northeast about 150 miles to Columbus, with a further possible extension to Birmingham, Ala., and Nashville, Tenn. A branch is also proposed to Aberdeen, Miss. Leake County has pledged right of way and other counties will be asked to do the same. The officers are given under Elections and Appointments.

JAMESTOWN, CHAUTAUQUA & LAKE ERIE.—This company was incorporated in New York, Sept. 25, with a capital stock of $750,000, to build a railroad from Mayville, N. Y., northwest 10.1 miles, to Westfield. The Jamestown & Chautauqua is building an extension between these two points. The directors of the new company are: Charles M. Preston, Henry B. Wilson, Edwin E. Witherby, William B. Anderson, William Williams, Maitland F. Griggs, William Lord Sexton, Charles H. Ludington, Jr., and Otto T. Hess, all of New York City. (J. & C., Aug. 10, p. 546.)

KANSAS CITY, FORT SCOTT & MEMPHIS.—An officer declares entirely unwarranted the report that an extension is to be built from Miami, Ind. T., southwest. (Sept. 21, p. 628.)

KENTUCKY ROADS.—L. K. Rice, C. E., of Harlan, Ky., acting for individual land owners in Philadelphia, writes that he has made reconoissance for a railroad from either Pineville or Middlesboro, on the Louisville & Nashville, northeast to Harlan, 35 miles. (Sept. 14, p. 614.)

LONG ISLAND.—Preliminary work is reported under way for removing the sharp curve at the Cold Spring Station, L. I.

MASSILLON & LITTLE BEAVER.—This company has been incorporated in Pennsylvania to build a railroad five miles long in Beaver County. Joseph Wood, Vice-President of the Pennsylvania Co., is President of the new company.

NEW YORK & NEW ORANGE.—Surveys are reported in progress for an extension from New Orange, N. J., north through Union and Irvington to Vailsburg.

NORFOLK & WESTERN.—Right of way is reported being secured for an extension from Ivanhoe, Va., west about 20 miles to Speedwell, in the Cripple Creek Valley.

NORTHERN PACIFIC.—Surveys have been made for extensions from Grantsburg, Wis., southeast, and from Hoquiam, Wash., toward Quinault. The report that the company proposes to build into the Big Horn Basin in Wyoming is in error. (Official.)

The company is reported building nearly 8,000 ft. of side track at Seattle, Wash.

OLEY VALLEY.—This company has been incorporated in Pennsylvania, with a capital stock of $200,000, to build a railroad from Reading east about 15 miles to Boyertown. John A. Rigg, Reading, is President.

PELLA & SOUTHWESTERN.—This company was incorporated in Iowa, Sept. 22, with a capital stock of $100,000, to build a line from Pella southwest about five miles to Howell on the Wabash, which company is understood to be back of the project.

PENNSYLVANIA.—Plans are reported being made for an extension of the Western Pennsylvania from Saltsburg south four miles into Salem Township, Westmoreland County, Pa.

PHILIPPINE ROADS.—Major Thomas L. Hartigan is reported to have resigned his commission in the Thirteenth Infantry, U. S. Volunteers, to accept the position of General Manager of a new railroad to be built on the Island of Luzon from Manila northeast to Caloocan and other points. Previous to his acceptance of a commission in the army he was a lawyer in Chicago.

PITTSBURGH & WESTERN.—Preparations are being made to change the line from Butler, Pa., north to Foxburg from narrow gage to standard. The company will also remove the top of tunnel No. 3 near Glenshaw, eight miles north of Pittsburgh.

QUEBEC & NEW BRUNSWICK.—At the annual meeting, held in Quebec, Sept. 20, it was stated that surveys are completed on the line except on the section from the foot of Boundary Creek for a few miles westward. Offers have been received to build the line. It is projected from Connor Station, on the St. Francis branch of the Temiscouta line in New Brunswick, to run to a point on the Intercolonial at or near St. Charles Junction, or to a point on the Maine Central near St. Anselme, or to a point on the Grand Trunk near Chaudiere Junction, 130 miles. The Honorable John Costigan, of St. Johns, N. B., is President. (Sept. 14, p. 614.)

RIO GRANDE WESTERN.—Building is to be begun at once on the Utah Central cut-off just outside of Salt Lake City, Utah, from the old sugar house along Twelfth South street.

TOLUCA, MARQUETTE & NORTHERN.—Contracts will be let at once for grading this line from Toluca, Ill., north through the counties of Marshall, Putnam and Bureau to Marquette. The principal office is Chicago. (Sept. 14, p. 614.) The officers are given under Elections and Appointments. (Official.)

UNION SPRINGS & NORTHERN.—Application was filed Sept. 19, in Alabama, for a charter for this company to build from Union Springs north about seven miles to Fort Davis, and thence about 14 miles to Tuskegee.

WARRENTON, BETHANY & WASHINGTON.—This company has been incorporated in West Virginia, with a capital stock of $1,000,000, to build a railroad in Brooke County from a point on the Ohio River opposite Warrenton, Ohio, north about 10 miles to Bethany. The right of way is reported secured and contracts are to be let within two or three weeks. The road is to be used chiefly for carrying coal. The incorporators are: James H. McRoberts and William H. McKinley, Pittsburgh, Pa.; Thornton M. Johnston, Alexander L. Arthur and W. H. Bradley, New York.

WHITE PASS & YUKON.—The company has under consideration a branch line to the White Horse mines, seven miles.

WISCONSIN CENTRAL.—Work is to be begun soon, according to report, on extensive terminals on Boom Illard at Minneapolis, Minn.

WISCONSIN ROADS.—An agreement is reported between Langley & Alderson and the Merrill Lumber Co. to build a logging road 11 miles long into tracts of timber above Star Lake, Wis., owned by the Merrill Co. This is presumably to connect with the Chicago, Milwaukee & St. Paul.

WYOMING & WESTERN.—This company was incorporated in Wyoming, Sept. 17, by officers of the Oregon Short Line, to build a line from Kemmerer to run south to Happy Hollow, about 40 miles, on the main line of the Union Pacific west of Evanston. Grading is reported begun at Kemmerer.

GENERAL RAILROAD NEWS.

ASHLAND & WOOSTER.—H. B. Camp, of Akron, Ohio, President of the company, confirms the statement that between nine and 10 miles of the eastern end of this line has been sold to the Pennsylvania Company for $80,000. This sale includes considerable rail piled along the road but not yet laid. (Sept. 14, p. 614.)

CHESAPEAKE & OHIO.—At the annual meeting, Oct. 23, the stockholders will vote on a proposition to aid the new Greenbrier road by guaranteeing its $2,000,000 of 4 per cent. 40-year sinking fund bonds. Last year the stockholders voted to issue $3,000,000 of C. & O. 4 per cent. bonds to provide for building this line. This new proposition is in lieu of the old one. (Construction Supplement, July 27, 1900.)

CHICAGO & NORTHWESTERN.—The $897,000 Iowa Midland first mortgage 8 per cent. bonds, due Oct. 1, will be paid at the New York office at maturity.

DETROIT & LIMA NORTHERN.—W. B. Strang, Jr., New York, and Chas. N. Haskell, of Ottawa, Ohio, on Sept. 21, bought the Columbus & Northwestern extension of this company at Special Master's sale at Bellefontaine, Ohio, for $200,200. (Sept. 14, p. 614.)

GEORGIA & ALABAMA.—The greater portion of the preferred and common stocks has been deposited with the Seaboard Air Line representatives and has been turned over to the Continental Trust Co., Baltimore, to be converted into the securities of the new S. A. L. (May 25, p. 348.)

LITTLE ROCK BRIDGE (CHOCTAW, OKLAHOMA & GULF.)—On June 30, 1900, the Choctaw, Oklahoma & Gulf took over the franchises of the Choctaw & Memphis and assumed its bonded indebtedness, which include the $375,000 bonds of the Little Rock Bridge Co. These are first mortgage 6 per cent. gold bonds, secured on the bridge over the Arkansas River at Little Rock. There is a sinking fund of $21,000 per year commencing in 1903, under which 20 bonds are authorized paid at 105 and interest.

LOUISVILLE, EVANSVILLE & ST. LOUIS.—The unassenting holders of second mortgage 6s represented by the Fidelity Trust Co., of Louisville, under the recent agreement with J. P. Morgan & Co., will receive new 4 per cent. bonds in exchange for their old bonds at par. The original plan offered them $700 in new bonds. (Sept. 14, p. 614.)

MUNISING.—A Western press report states that this property, including 100,000 acres of hardwood land, has been sold to Wm. G. Mather, President of the Cleveland Cliffs Iron Co., of Cleveland, Ohio, which company also controls the Lake Superior & Ishpeming Ry., and a number of mines in the Upper Peninsula, Mich. The road extends from Munising, Mich., to Little Lake, 38 miles.

NEW YORK CENTRAL.—The Board of Directors, on Sept. 19, voted to approve the lease of the Boston & Albany, as amended by the Massachusetts Legislature, and call was issued for a meeting of the stockholders to be held in Albany, Nov. 8, to ratify the action of the Board. (B. & A., July 27, p. 518.)

NORTHERN PACIFIC.—The directors, on Sept. 19, approved of the traffic agreement between the company and the Chicago, Milwaukee & St. Paul for the use by the N. P. of the St. Paul & Duluth tracks from St. Paul, Minn., to Duluth. (C., M. & St. P., Aug. 10, p. 546.)

OMAHA & ST. LOUIS.—A bill of complaint was filed in the U. S. Court at Council Bluffs, Iowa, by the Guaranty Trust Co., New York, and Julius Walsh, of St. Louis, against this company, and its receivers, against the Missouri Construction Co., and the receivers of the Kansas City, Pittsburgh & Gulf. The complainants state that the railroad has defaulted in the payment of the interest on the first mortgage bonds, due on Jan. 1 and July 1 of this year, and has failed to make payments of taxes, etc. They ask that a new receiver be appointed by the court. (June 15, p. 408.)

SEATTLE & TACOMA ELECTRIC.—A syndicate, composed of Jacob Furth, of Seattle, and associates, has taken control of this company, which is building an electric line from Seattle to Tacoma, 30 miles. The change was effected Sept. 18. The new officers are given under Elections and Appointments. (Construction Supplement, July 27, 1900.)

WILLIAMSPORT & NORTH BRANCH.—The company's mortgage of 1892 authorized an issue of $2,000,000 at $25,000 per mile. On this there has been issued $1,125,000 on 45 miles of road built and equipped. The present management has caused $525,000 of this issue of bonds to be cancelled, leaving $600,000 outstanding.